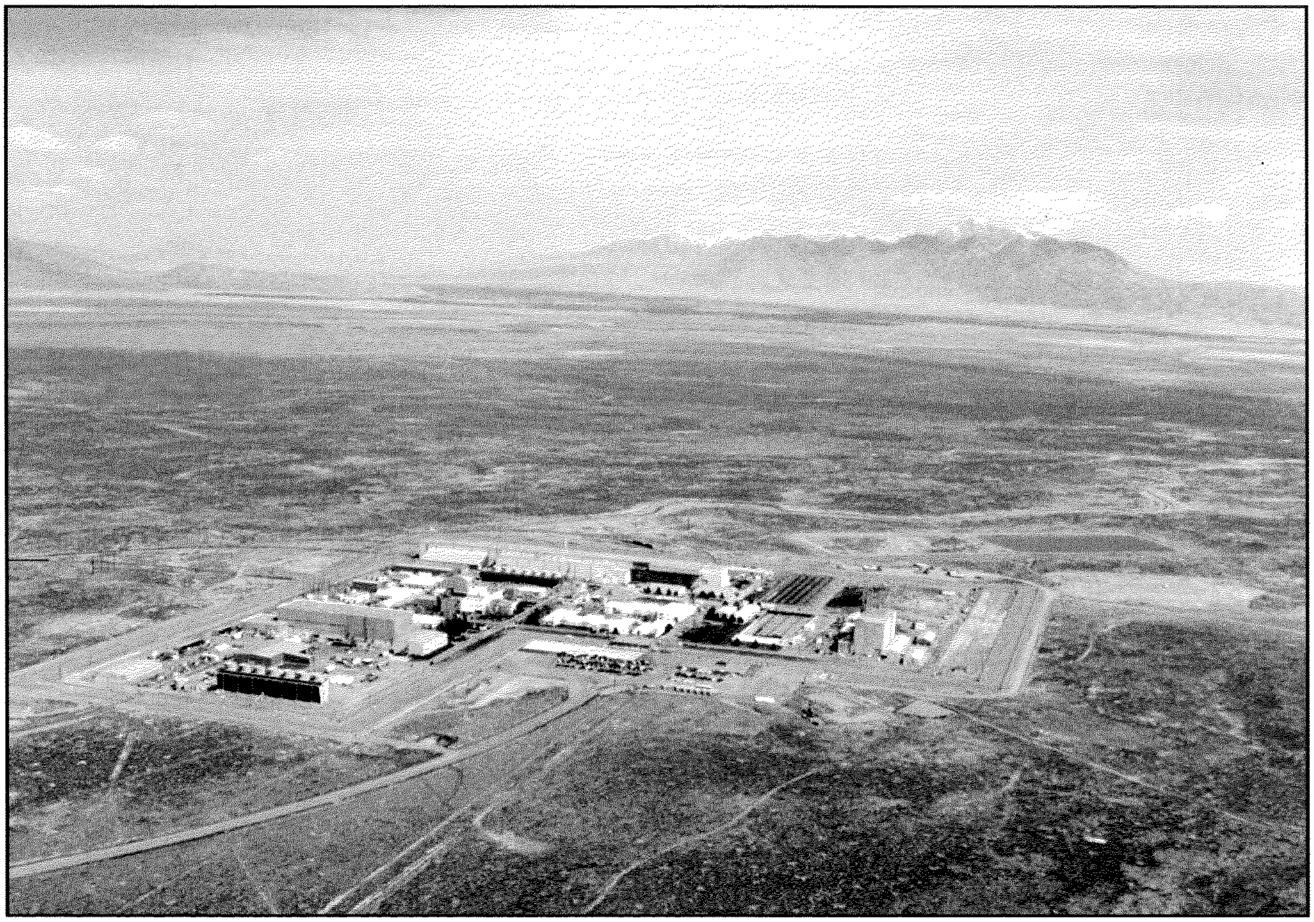
Phase II Remedial Design Report/ Remedial Action Work Plan Operable Unit 8-08



Naval Reactors Facility

BECHTEL

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Final

Phase II Remedial Design Report and

Remedial Action Work Plan

for Operable Unit 8-08

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Prepared for the
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Acronyms

A1W	Large Ship Reactor Prototype (1st Aircraft Carrier design by Westinghouse)
ARAR	applicable or relevant and appropriate
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Central Facilities Area
CQA	Construction Quality Assurance
DOE	Department of Energy
DOT	Department of Transportation
ECF	Expended Core Facility
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Differences
ET	evapotranspiration
FFA/CO	Federal Facility Agreement and Consent Order
HASP	Health and Safety Plan
HELP	Hydrological Evaluation of Landfill Performance
ICP	Institutional Control Plan
IDEQ	Idaho Department of Environmental Quality
INEEL	Idaho National Engineering and Environmental Laboratory
NOAA	National Oceanic and Atmospheric Administration
NRF	Naval Reactors Facility
O&M	Operation and Maintenance
OU	Operable Unit
pCi/g	picocuries per gram
ppm	parts per million
RA	remedial action
RCRA	Resource Conservation and Recovery Act
RD	remedial design
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
RWMC	Radioactive Waste Management Complex
S1W	Submarine Thermal Reactor Prototype (1st Submarine design by Westinghouse)
S5G	Submarine Reactor Plant Prototype (5th Submarine design by General Electric)
SOW	Scope of Work
SRP	Snake River Plain
SRPA	Snake River Plain Aquifer
TBC	to be considered
WAG	Waste Area Group

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Phase II Remedial Design Report/Remedial Action Work Plan for Operable Unit 8-08

1.0 Introduction

The Phase II Remedial Design/Remedial Action (RD/RA-II) Work Plan for Operable Unit (OU) 8-08 is considered to be a final design and plan of work of the remaining major work elements associated with the remedial actions at the Naval Reactors Facility (NRF) that were identified in the Remedial Design/Remedial Action (RD/RA) Scope of Work (SOW) and not covered by the RD/RA-I Work Plan. The RD/RA-II Work Plan builds upon the preliminary design presented in the draft RD-II Work Plan. Comments on the draft RD-II Work Plan were received from the Idaho Department of Environmental Quality (IDEQ) and the Environmental Protection Agency (EPA) Region 10. Responses to these comments are provided in Appendix J. Comments on the draft RD/RA-II Work Plan were received from IDEQ and the EPA, and responses are provided in Appendix K. Comments on the draft final RD/RA-II Work Plan were received from IDEQ and the EPA, and responses are provided in Appendix L.

The Record of Decision (ROD) for OU 8-08 identified nine sites of concern that require remedial actions. The selected remedial actions include excavation and consolidation of contaminated soils and the construction of engineered covers. To expedite the remedial action process, the remedial actions were split into two distinct phases. Phase I, which is currently ongoing, includes the excavation and consolidation of contaminated soils from the sites of concern and the work elements necessary to accomplish these actions. Phase II consists of the construction of engineered covers in three locations and associated work elements. This work plan pertains to the Phase II aspects of the remedial actions. The purpose of these actions is to address the Remedial Action Objectives listed in the ROD. For human health protection, this includes preventing external gamma radiation exposure from all radionuclides of concern, preventing ingestion of soil and food crops contaminated with radionuclides of concern, and preventing exposure to soil contaminated with lead. For environmental protection, this includes preventing erosion or intrusion by resident plant or animal species in contaminated soils and preventing exposure to contaminants of concern that may cause adverse effects on resident species populations. The methods used to meet the Remedial Action Objectives are described as follows: provide a barrier against direct contact with the contaminated soil by potential receptors, restricting access and land use, reducing the mobility of contaminants in the environment, and performing maintenance and monitoring to ensure detection of potential contaminant migration.

The major work project associated with Phase II remedial actions includes the construction of engineered covers at three locations. Additional work projects associated with the Phase II remedial actions include monitoring activities (associated with the operation and maintenance phase) and the implementation of institutional controls. Each major work project contains several work elements that will be discussed in detail later in this document. The RD-II Work Plan provided the preliminary design, the management approach, and the work elements for the implementation of the selected remedy. This RD/RA-II Work Plan provides the documentation and planning for initiating the remedial action activities, which implement the field work phase of the selected remedy. The following documents are included in the RD/RA-II Work Plan: (1) Operation and Maintenance (O&M) Plan, (2) Institutional Control Plan (ICP), (3) Waste Management Plan, (4) Health and Safety Plan (HASP), and (5) Construction Quality Assurance (CQA) Plan.

2.0 Background

To facilitate the management of environmental investigations under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Idaho National

Engineering and Environmental Laboratory (INEEL) was divided into ten Waste Area Groups (WAGs), of which NRF was designated as WAG 8. OU 8-08 was the Comprehensive Remedial Investigation/Feasibility Study (RI/FS) of NRF and included 18 radiological sites. The RI/FS identified nine of the 18 sites as sites of concern. The remaining nine sites were determined to be either No Action or No Further Action sites. The ROD for OU 8-08 selected remedial actions for the nine sites that involved limited excavation, disposal, and containment. Eight of the nine sites were selected for limited excavation and disposal remedial action work tasks. These actions are currently being conducted under the Phase I RD/RA Work Plan. The remediation goals were established in the ROD for these nine sites and were based on human health risks and are also considered protective of ecological receptors. The ROD identified three constituents that required specific remediation goals for the excavation activities. The remediation goals for the nine sites of concern are 16.7 picocuries per gram (pCi/g) cesium-137, 45.6 pCi/g strontium-90, and 400 parts per million (ppm) lead. Of these nine sites only three (including two that had some excavation and disposal actions) were originally selected for containment as discussed in the ROD and in the RD-II Work Plan. However, due to the significant amount of contamination (encompassed in a larger area than expected) and obstacles encountered at the Old Sewage Basin (NRF-21A) during the Phase I Remedial Action work activities, an Explanation of Significant Difference for this site recommending containment as the preferred remedial action was approved by the EPA and the State of Idaho. Containment for the selected sites will be accomplished by the placement of engineered covers over the contaminated soil above remediation goals and any remaining piping within these sites. The selected sites, covered under this Phase II Remedial Action, are designated as NRF-21A, NRF-19, NRF-12B, and NRF-14. Sites NRF-12B and NRF-14 are in the same general area and will be addressed by a single cover. The locations of the four sites of concern are depicted on Figure 1. These sites are identified below and are discussed in the following sections.

2.1 Site Geology

The following is a general geologic description of the NRF site and in the vicinity of NRF-14, NRF-12B, NRF-19, and NRF-21A. A detailed geologic description is given in the Five-Year Review Document for the NRF Inactive Landfill Areas (BBI, 2001). The NRF site is located at the central northern edge of the eastern Snake River Plain (SRP). The SRP is underlain by a large structural basin that was filled by a layered sequence of basaltic lava flows and thin sedimentary interbeds that are intercalated. The ground surface of the SRP, including the NRF site, is typically covered with a soil mixture of fine-grained clay and sand geologically known as loess. The surface loess deposit at NRF ranges in thickness from a few inches to about 10 feet. Beneath the surface loess deposits lies an alluvial sequence that varies in thickness from a few inches to approximately 60 feet at the NRF site. The alluvium overlies basalt and consists of interbedded, poorly sorted sand and gravel, and occasionally, thin clay layers. In certain areas around NRF, the alluvium overlies a fluvial/lacustrine clay layer which in turn overlies basalt. This clay layer fills low areas of the basalt (typically, where the top of the basalt is deeper than 20 feet) and ranges in thickness from absent to several feet. Borings drilled around the NRF site indicate that the fluvial/lacustrine unit is encountered in isolated areas throughout the NRF site. Depth from the surface to the top of the basalt ranges from zero to 60 feet but is typically around 30 feet. Drilling performed during a previous investigation indicates that the top of the basalt in the vicinity of NRF-14 and NRF-12B ranges from about 30 feet to 37 feet (EG&G, 1988). The top of the basalt in the vicinity of NRF-19 ranges from about 12 feet to 20 feet (EG&G, 1988). The top of the basalt in the vicinity of NRF-21A ranges from about 15 to 21 feet (WEC, 1997).

The depth to the Snake River Plain Aquifer (SRPA) at NRF is approximately 375 feet below the surface (BBI, 2001). The regional groundwater flow direction at NRF is predominantly towards the south - southwest.

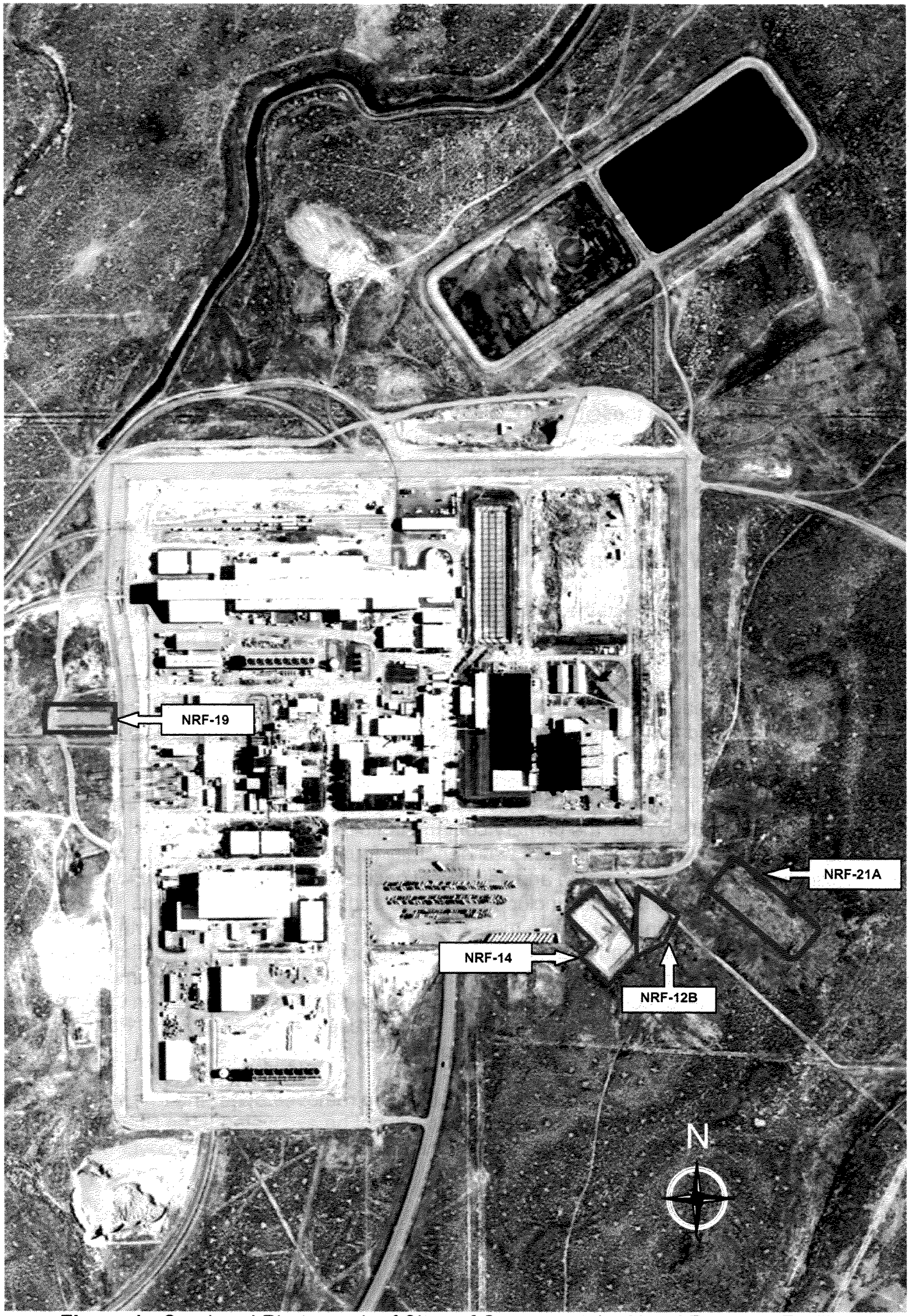

Figure 1. Overhead Photograph of Sites of Concern at the Naval Reactors Facility

In the past, perched water has been observed beneath NRF at two principle depths. The first occurrence is at or near the top of the basalt. In nearly all instances where a significant surface water source has been present, a perched water zone has formed at the top of the basalt, typically in areas where the top of the basalt is overlain by the fluvial/lacustrine layer. In the past, shallow perched water zones were observed beneath the inactive leaching beds/pit NRF-14, NRF-12B, and NRF-19, when these sites were in operation, (EG&G, 1988). Perched water has also occurred at approximately 100 feet below the land surface at a sedimentary interbed. Other similar perched water zones may have been present at other NRF locations in the past where significant recharge sources were present.

Currently, there are no significant recharge sources present at OU 8-08 sites. The recharge sources that were present at NRF-12B, NRF-14, and NRF-19 have been non-existent for at least 23 years. Boreholes that have been drilled during the remedial investigation to the top of the basalt in these areas have not detected any evidence of current perched water bodies. Three boreholes were drilled to the basalt on the north, west, and south side of NRF-12B and NRF-14 where a historic perched water layer existed above the basalt. Small amounts of contaminants were found in these boreholes, but no residual water was apparent. Several boreholes were drilled to the basalt on all sides of NRF-19 and again small levels of contaminants were detected, but no residual water.

2.2 Site Description and History

2.2.1 NRF-12B (S1W Leaching Pit)

In 1957, a pit was constructed at the end of an underground, perforated pipe drainfield (NRF-12A). This pit was known as the S1W Leaching Pit (NRF-12B). The pit was used from 1957 until 1961 when it was filled in with soil. The pit was approximately eight feet wide, eight to ten feet deep, and 50 feet long. The leaching pit was evaluated in the NRF Comprehensive RI/FS with the S1W Leaching Beds (NRF-14) because the pit is adjacent to NRF-14. The sampling plan identified the leaching beds and leaching pit as one sampling area, since they had similar discharges, were located next to each other, and had the same sampling goals. The releases to the pit included a significant portion of the estimated 64,100,000 gallons of radioactive effluent containing 67.9 curies of radioactivity that were discharged to the drainfield. Cesium-137 and cobalt-60 were the primary contaminants released. During the RI/FS sampling, the radionuclide contamination was generally found at the 14 foot depth within the pit or in proximity to the pit (on the south and southwest end toward the fence surrounding the area). Other contaminants detected included nickel-63 and strontium-90. During characterization sampling in 1991, some metals were detected at a three-foot depth (arsenic at a maximum of 100 ppm and lead at a maximum of 1,140 ppm), but this is suspected to be from soil placed over the area after it was no longer used. Table 2-1 provides the maximum sample results for contaminants of concern from various sampling efforts at NRF-12B. An asphalt cover was placed over the leaching pit location in 1978 and is present at the site today. Past and present photographs of NRF-12B are included Appendix B.

The underground pipe that leads to the leaching pit will be removed under the Phase I Remedial Action. However, the pipe beneath the asphalt cap will not be excavated. The Phase II Remedial Action associated with this site is the construction of an engineered cover over the area.

Table 2-1. Risk-based Soil Concentrations and Maximum Concentrations (pCi/g or (for lead) ppm) of COCs Detected at OU 8-08 Sites

Risk-based Soil Concentrations[a]	**Lead[b]**	**Am-241**	**Cs-137**	**Np-237**	**Ni-63**	**Pu-238**	**Pu-244**	**Sr-90**	**U-235**
Direct Contact	400[c]	NA	NA	NA	NA	NA	NA	NA	NA
External Exposure	NA	895	16.7	NA	NA	NA	3.3	NA	13.2
Ingestion of Soil	NA	283	24,860	NA	NA	590	NA	15,418	NA
Food Crop Ingestion	NA	301	164	19.8	15,846	1,153	NA	45.6	NA
OU 8-08 Site Maximum Concentrations Observed									
NRF-12B	1,140[d]	0.15[e]	1,600[e]	ND	171.4[e]	0.15[e]	ND	37.3[e]	ND
NRF-14	150[f]	5.9[d]	26,800[g]	0.79[e]	730[d]	5.9[d]	0.24[h]	83[d]	0.17[i]
NRF-19	20.1[j]	20[d]	1,390[d]	0.382[j]	730[d]	20[d]	ND	750[d]	ND
NRF-21A	150[e]	ND	3,400[k]	ND	7.74[e]	ND	ND	2.02[e]	ND

ND – Not Detected
NA – Not Applicable

(a) Concentrations correspond to a 1 x 10^{-4} carcinogenic risk.
(b) Lead results derived from total metals analysis.
(c) EPA recommended screening level for lead cleanup.
(d) Pre-RI/FS Characterization Sampling.
(e) RI/FS Sampling.
(f) Maximum sample result from RI/FS sampling at NRF-21A. Some of NRF-21A soil was placed in NRF-14.
(g) Sample collected during remedial action at NRF-21A. Sample is believed to be from a radioactive particle and not representative of soil conditions.
(h) RI/FS sampling from NRF-12A. Soil from NRF-12A was placed in NRF-14.
(i) RI/FS sampling from NRF-21B. Soil from NRF-21B is to be placed in NRF-14.
(j) Remedial Action confirmatory sampling.
(k) Remedial Action samples collected during excavation.

2.2.2 NRF-14 (S1W Leaching Beds)

The first S1W Leaching Bed (the north bed) was constructed in 1960. The bed was an open pond that allowed the water to evaporate or infiltrate into the ground. A second bed (the south bed) was constructed in 1963 adjacent to the first bed. Each bed was about 75 feet by 125 feet at the water line and was 13 to 15 feet deep. The beds originally received radioactive effluent from the S1W prototype plant, and later received effluent from the S5G and A1W prototypes and the Expended Core Facility (ECF). The beds were used from 1960 to 1979 and received approximately 250,000,000 gallons of water containing 131 curies of radioactivity. The primary radionuclides released were cesium-137, cobalt-60, and tritium. Tritium, which exists in the form of water, would not be expected in the soil directly beneath the leaching beds today. However, elevated amounts of tritium above background have been detected in the groundwater downgradient of the leaching beds. The source of the tritium may be attributed to a potential residual perched water zone located within a sedimentary layer at a depth beneath the leaching beds (BBI, 2001). Cobalt-60, with a half-life of only five years, would have decayed to very small levels by now. Small amounts of chemicals and oil may have been released to the leaching beds. Construction figures of the leaching beds are shown in Appendix A, Figure 1. Past and present photographs of NRF-14 are shown in Appendix B.

Large cobblestones were placed in the leaching beds in 1972 to prevent the spread of radioactive contamination by various mechanisms (e.g., water fowl, windblown contaminated dust from the bed). Earthen ramps were constructed to allow sampling equipment into the beds in 1992. Samples were collected from below the bottoms of the beds in 1992, and remedial investigation sampling was performed in 1996 around the outside of the beds. Table 2-1 provides the maximum sample results for the contaminants of concern from various sampling efforts at NRF-14

The extent of contamination at NRF-14 is primarily within the soil directly below the leaching beds. The borehole sampling adjacent to the leaching beds showed only small amounts of contaminants. The contaminants are primarily retained within the top three feet of the bottom of the leaching beds.

Under the Phase I Remedial Action, part of the remedy included the consolidation of contaminated soil from other 8-08 sites. Soil was placed in soft-sided containers, then transported and placed in the leaching beds. It is anticipated that the soft-sided containers will be stacked in two layers within the leaching beds, and that two areas in proximity to the leaching beds (but still within the fenced area that encompasses the leaching beds and leaching pit) will be used for the placement of additional soft-sided containers.

The underground pipe that led to the leaching bed was removed (with the exception of about a 20 foot section closest to the leaching bed and the pipe within the leaching bed) under the Phase I Remedial Action. Based on excavation angles of repose, and the desire not to disturb the contaminated soil within the leaching beds proper, this was the maximum practical amount of piping to remove. Phase II activities will include the construction of an engineered cover over the leaching beds and the remaining underground pipe.

2.2.3 NRF-19 (A1W Leaching Bed)

The A1W Leaching Bed (NRF-19) was constructed west of NRF in 1957. The A1W Leaching Bed was similar to a drainfield with underground, perforated pipes distributing the liquid to an area constructed of gravel and sand. The bed was 200 feet long and 50 feet wide. The bed was used continually from 1958 to 1964 for effluent discharges from the A1W prototype and the Expended Core Facility (ECF). The bed was used sporadically from 1964 until 1972, when use was discontinued. Appendix A, Figure 2, shows a schematic as-built drawing of the leaching bed. Past and present photographs of NRF-19 are shown in Appendix B.

A total of 85,500,000 gallons of water containing 141 curies of radioactivity was discharged to the leaching bed. The primary contaminants released were cesium-137, cobalt-60, strontium-90, and tritium. Cobalt-60, with a half-life of only five years, would have decayed to very small levels by now. Tritium, which exists in the form of water, would not be expected in the leaching bed today. The leaching bed may have received small quantities of chemicals and oil associated with various processes at A1W and ECF. Table 2-1 provides the maximum sample results for the contaminants of concern from various sampling efforts at NRF-19.

Two underground pipes that led to the leaching bed were removed (with the exception of about 10 foot sections closest to the leaching bed and the pipes within the leaching bed) along with contaminated soil under the Phase I Remedial Action. Phase II Remedial Action activities will include the construction of an engineered cover over the leaching bed and the remaining underground pipes.

2.2.4 NRF-21A (Old Sewage Basin Area)

In 1956, a sewage basin (NRF-21A) was constructed to the southeast of NRF. The sewage basin was an open pond that was originally 72 feet by 72 feet and 11 feet deep. A 10 inch concrete pipe leads to the sewage basin from the L-shaped sump (part of NRF-11). The basin was cross-contaminated from the radiological discharge system in 1956. An unknown amount of radioactive effluent was sent to the sewage basin. The basin was enlarged in 1957 in the southeast direction to more than triple the original length and was used until 1960. The basin has since been filled in with soil. Appendix A, Figure 3, shows a schematic of the original as-built drawing of the sewage basin. Appendix B includes past and present photographs of NRF-21A.

Originally, the maximum extent of contamination above cleanup levels at the sewage basin was believed to have been in the 72 by 72 foot area (the area encompassed by the original as-built basin) with a maximum two foot thickness at a minimum depth of 14 feet below the surface (this depth included the height of the mound over the expanded basin). However, during the Phase I Remedial Action work activities, the actual conditions observed were different than expected. Contamination was found in the expanded portion of the basin as well. Depth to contamination around the basin periphery (sloped sides) is generally 5 to 6 feet in the original basin, and about 8 feet in the expanded basin. Depth to contamination along the bottom of the basin is about 11 to 12 feet (below natural grade) in the center of original basin and 10 to 11 feet (below natural grade) in the center of the expanded basin. Average thickness is about 2 feet everywhere except near the cistern, or distribution pipe at the inlet to the basin, where it was about 4 feet (most of which has been removed under Phase I work activities). The mound over the basin is about 3 feet high with some areas being closer to 5 feet. Table 2-1 provides the maximum sample results for the contaminants of concern from various sampling efforts at NRF-21A.

The following excavation and removal actions were accomplished during the Phase I Remedial Action work activities. The pipe and associated contaminated soil from the L-shaped sump to the original basin were removed. The cistern at the inlet to the basin was also removed along with some of the contaminated soil within the original basin. The total amount of contaminated soil removed thus far from NRF-21A is approximately 22,300 ft^3. This is significantly more than the original 10,400 ft^3 estimated, and a large portion had come from along the pipe where contamination was not expected. No contaminated soil has been removed from the expanded portion of the basin and a significant amount of contaminated soil still remains in the original basin. As discussed earlier, an Explanation of Significant Difference (ESD) was submitted to the State of Idaho and the EPA for this site recommending containment as the preferred remedial action, rather than continued excavation. The State of Idaho and the EPA have recently approved the ESD and it has been released to the public. Therefore, Phase II planning will include the construction of an engineered cover over the entire basin area.

3.0 Remedial Actions

The specific remedial actions resulting from the selected remedy addressed in the ROD for the four designated sites, where the primary objective of the remedy is to prevent direct exposure to contaminated soil, are summarized below.

As previously discussed, four of the sites have been designated for containment as one of the actions included in the selected remedy. Containment involves the placement of a structure (such as an engineered cover) that acts as a barrier, and prevents leachate generation that could lead to contaminant migration. This keeps the contaminants effectively isolated and in place. An engineered cover will be placed over each site to prevent receptor exposure to contaminants of concern by restricting three potential pathways: exposure to gamma radiation, ingestion of soil and food crops, and direct contact exposure. The covers will also reduce the potential for migration of contaminants from the sites. The soil cover design will incorporate various control measures (i.e., a vegetative cover and biobarrier), to inhibit erosion by natural processes and biotic intrusion by resident plant or animal species.

Other actions included in the selected remedy are monitoring activities, maintenance activities, and institutional controls. Soil and groundwater monitoring will be performed to monitor any potential releases from the covered areas, even though infiltration of contaminants to the groundwater is not included as a pathway of concern in the ROD. Surface soil monitoring will consist of radiation surveys and soil/vegetation sampling to provide early warning of potential releases of radionuclides that may be mobilized by burrowing animals, erosion, or other natural processes. Soil moisture monitoring of the covers will be performed to assess the performance of the covers by providing an indication of moisture migration into the contaminated soil (this provides an early warning for the potential of contaminant migration). Provisions for maintenance of the engineered covers, including subsidence correction and erosion control, are included as part of the O&M phase (see Appendix C, O&M Plan) of this remedial action. To further prevent potential exposure to the contaminants, institutional controls (i.e., access and land use restrictions) will be implemented (see Appendix D, Institutional Control Plan).

The remedial actions for Phase II consist of the following elements: 1) design and placement of the engineered caps; 2) operation and maintenance efforts (including monitoring activities); and 3) institutional controls (i.e., placement of visible access restrictions, and administrative controls to restrict land use). The details of these three work elements are discussed in the following sections.

3.1 Engineered Cover

The engineered cover project will involve the following work elements:

- Designing the engineered covers
- Surveying and marking the individual areas
- Site preparations for cover placement
- Construction of engineered covers over the radioactively contaminated soils
- Installation of access tubes within the cover areas for moisture monitoring
- Pre-final inspection.

The contaminated soil above remediation goals and any existing piping within the leaching beds (NRF-14 and NRF-19), within the leaching pit (NRF-12B), and within the old sewage basin (NRF-21A: contaminated soil only, pipe has been removed) will remain in place and will be capped. The same basic engineered cover design will be used for each site. The preliminary design for the engineered covers is discussed in Section 4.0. The specific actions concerning the engineered cover for each site are described below.

3.1.1 S1W Leaching Pit (NRF-12B) and S1W Leaching Beds (NRF-14)

After operations were discontinued at NRF-12B, the leaching pit was filled in with soil and covered by asphalt, resulting in a mounded area. The mounded area rises about 5 feet above natural grade. The site is adjacent to the S1W Leaching Beds (NRF-14), with both sites encompassed within a fenced boundary. Other distinguishing physical features for NRF-12B include lava rocks scattered throughout the area, along with some small depressions that extend from the south end of the asphalt cap to the surrounding fence. A short section of pipe that runs into the bottom of the pit (under the asphalt cover) will be left in place after the main section of pipe designated as NRF-12A is removed under the Phase I Remedial Action. NRF-12B encompasses an area of about 26,000 square feet (sq. ft.).

Both NRF-14 leaching beds were covered with cobblestones and individually fenced. Other distinguishing physical features for NRF-14 include a berm around the beds that is 2.5 feet above natural grade, and minor depressions (some filled with gravel) outside the leaching beds. A section of pipe was left in place after the excavation activities conducted under the Phase I Remedial Action were completed. NRF-14 encompasses an area of about 24,000 sq. ft. The combined area encompassed by the perimeter fence around NRF-12B and NRF-14 is approximately 90,000 sq. ft. This fenced area includes the areas where soft-sided containers are being placed, both inside and outside the leaching beds. The approximate soft-sided container expansion areas are 12,400 sq. ft on the north side and 16,000 sq. ft. on the south side. The soft-sided containers will be double stacked in the leaching beds and in the expansion areas.

The area encompassed by the proposed engineered cover will include practically all of the combined area encompassed by the fence as depicted in Figure 2. The area to be encompassed by the engineered cover will be surveyed and marked to delineate the boundaries. Site preparation activities within the area designated for the cover will include site clearing, such as the removal of any remaining fencing and any other obstacles; grubbing of vegetation; and leveling of the existing fill material over the area. The asphalt cover over NRF-12B will be broken up and disposed of off-site away from NRF. Any debris generated will be characterized for off-site disposal (away from NRF) per the waste management plan (see Appendix E). The soft-sided container areas will be covered with fill material, including any voids between the containers and compacted as practical to minimize subsidence problems. The engineered cover will then be placed in accordance with the design parameters specified in the RD/RA-II Work Plan and relayed to the construction contractor via the technical specifications. Cover materials will be obtained from sources in the vicinity of NRF and within the INEEL with the exception of the biobarrier where materials will be obtained from commercially available sources. Access tubes will be placed within the cover area for soil moisture monitoring purposes. After the cover construction is complete, the sites will be managed in accordance with the O&M Plan, which includes site inspections and monitoring activities.

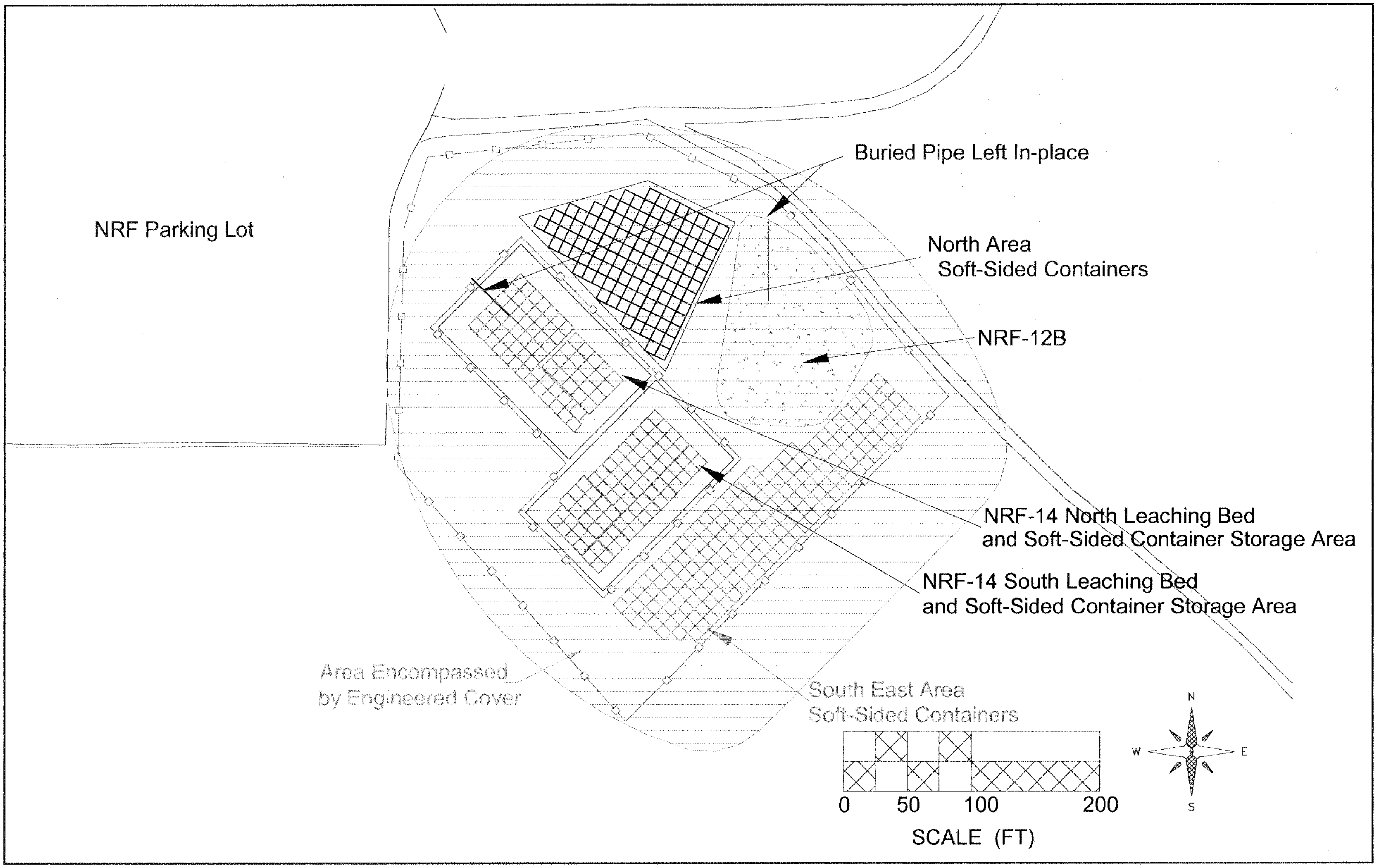

Figure 2. Approximate Area Encompassed by the Proposed Engineered Cover at Sites NRF-12B and NRF-14

3.1.2 A1W Leaching Bed (NRF-19)

This inactive site includes a fence surrounding the leaching bed with some vegetative growth on the surface of the bed. This site encompasses an area of approximately 13,700 sq. ft. Sections of two pipes (mainly within the leaching bed) were left in place after the excavation activities were completed.

The area encompassed by the proposed engineered cover will include all of the area encompassed by the fence as depicted in Figure 3. The area to be encompassed by the engineered cover will be surveyed and marked to delineate the boundaries. Site preparation activities within the area designated for the cover will include site clearing activities, such as the removal of fencing and any other obstacles; grubbing of vegetation; and the placement of fill material over the area. Any debris generated will be characterized for off-site disposal (away from NRF) per the waste management plan (see Appendix E). The engineered cover will then be placed in accordance with the design parameters specified in the RD/RA-II Work Plan and relayed to the construction contractor via the technical specifications. Cover materials will preferably be obtained from sources in the vicinity of NRF and within the INEEL with the exception of the biobarrier where materials will be obtained from commercially available sources. Access tubes will be placed within the cover area for soil moisture monitoring purposes. After the cover construction is complete, the site will be managed in accordance with the O&M Plan, which includes site inspections and monitoring activities.

3.1.3 The Old Sewage Basin (NRF-21A)

Some time after closure of the basin, it was filled in with soil and a small mound of soil approximately 3 feet high was created over the basin area. Recent information indicates that the basin was filled with material (soil and lava rock) from the S5G construction project. Within the middle of the mound, buried discarded roofing material (containing non-friable asbestos) was discovered during the Phase I Remedial Action activities. Approximately 40% of the mound has been removed along with some of the roofing debris due to excavation activities that took place during the Phase I Remedial Action. The rest of the mound will be removed during the site preparation activities under the Phase II Remedial Action. The excavation activities took place primarily over the original portion of the basin, which encompasses about a third of the entire site. Presently, a depression approximately 5 feet deep exists over the original basin as a result of soil removal in Phase I. All remaining contaminated soil was covered with clean fill. This depression will be filled in and compacted. Some vegetative growth exists on the surface of the mound (mostly in the expanded portion of the basin) that was not disturbed. The entire site (original and expanded portion of the basin area) encompasses an area of approximately 43,400 sq. ft.

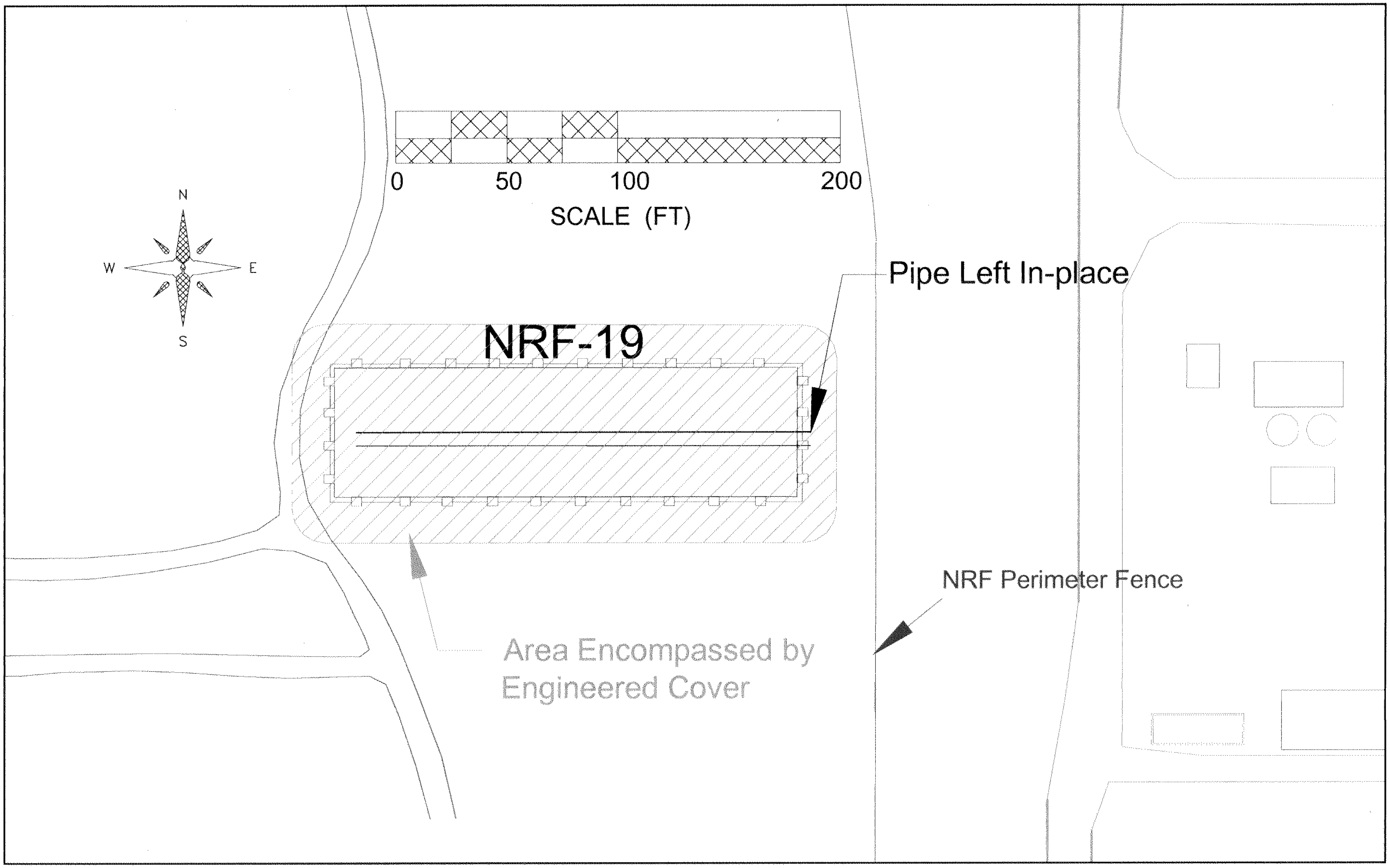

Figure 3. Approximate Area Encompassed by Engineered Cover at Site NRF-19

The area encompassed by the proposed engineered cover will include all of the area encompassed by the original fence and the mound area as depicted in Figure 4. The area to be encompassed by the engineered cover will be surveyed and marked to delineate the boundaries. Site preparation activities within the area designated for the cover will include site clearing activities, such as the removal of any debris, fencing, and any other obstacles; grubbing of vegetation; and placement of fill material over the area. Any debris generated will be characterized for off-site disposal (away from NRF) per the waste management plan (see Appendix E). The engineered cover will be placed in accordance with the design parameters specified in the RD/RA-II Work Plan and relayed to the construction contractor via the technical specifications. Cover materials will be obtained from sources in the vicinity of NRF and within the INEEL with the exception of the biobarrier where materials will be obtained from commercially available sources. Access tubes will then be placed within the cover area for soil moisture monitoring purposes. After the cover construction is complete, the site will be managed in accordance with the O&M Plan, which includes site inspections and monitoring activities.

3.2 Operation and Maintenance Activities

The OU 8-08 ROD included regulatory requirements for post-closure care of the areas identified for containment by the placement of an engineered cover. These requirements include the following:

- Maintain the integrity and effectiveness of the final cover by monitoring via site surveillances and providing custodial care as required, including making repairs as necessary to correct the effects of settling, subsidence, erosion, or other events
- Maintain and monitor the groundwater monitoring system
- Protect and maintain surveyed benchmarks of the capped areas
- Implement maintenance and surface monitoring programs for the containment systems capable of providing early warning of releases of radionuclides from the sites, before they leave the site boundary.

To ensure the engineered covers are maintained as intended, the O&M plan details the specific work activities to be performed as part of the remedial action. The O&M plan is included as Appendix C. The operation and maintenance activities include the following:

- Inspection and maintenance of the engineered covers to control erosion or damage from biotic intrusion
- Monitoring of the surface soil over the capped areas
- Moisture monitoring of the cover
- Groundwater monitoring
- General area maintenance.

The inspection of the engineered covers and monitoring will be conducted at the frequencies defined in the O&M Plan. Any adjustments to frequencies established in the O&M Plan will be made by agency consensus.

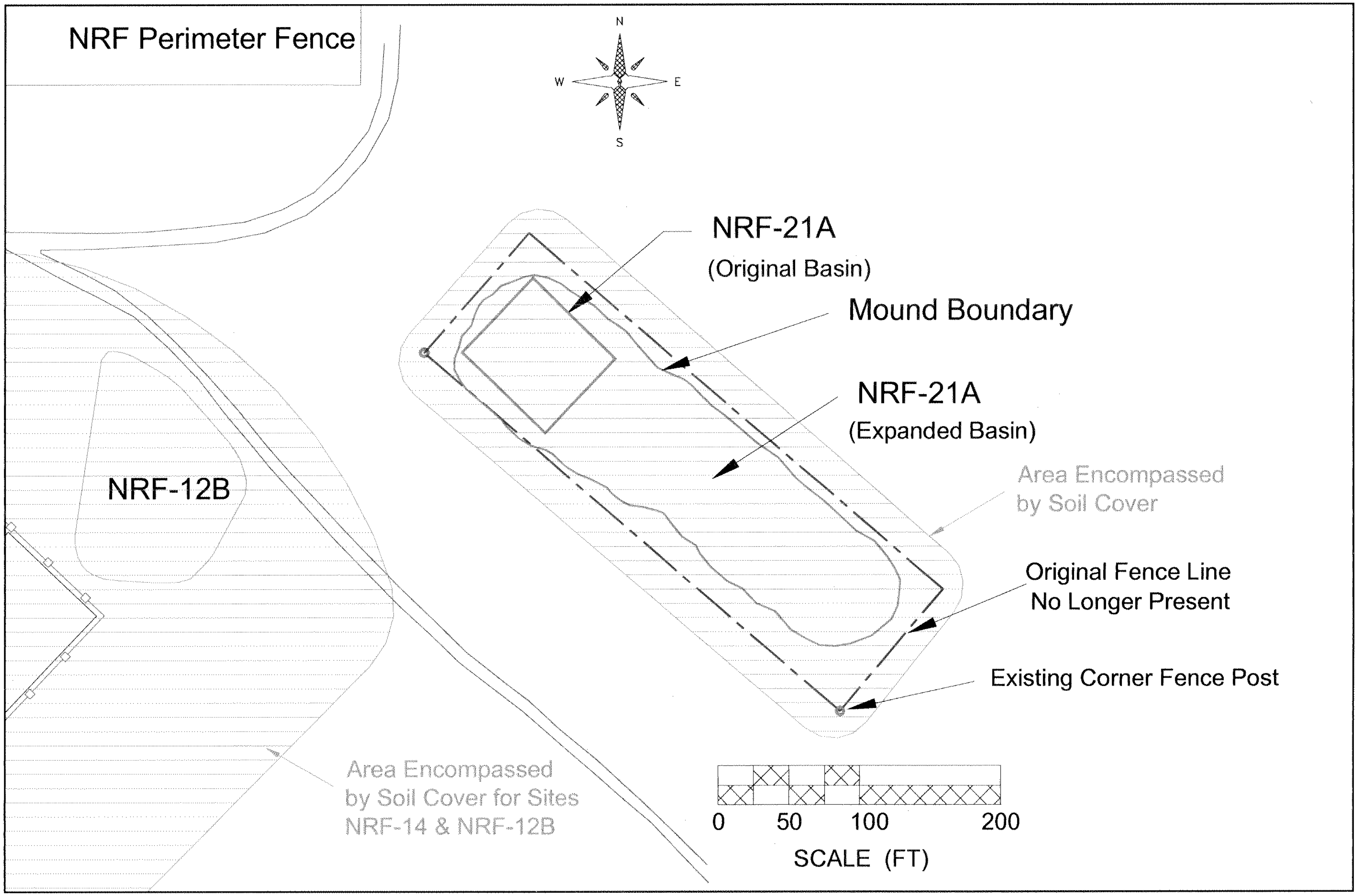

Figure 4. Approximate Area Encompassed by Engineered Cover at Site NRF-21A

3.3 Institutional Controls

Institutional controls were identified as part of the remedy in the ROD. An Institutional Control Plan (ICP) for OU 8-08 was provided as an appendix to the Phase I RD/RA Work Plan. The ICP was prepared to ensure that the remedy for the OU 8-08 sites of concern identified in the OU 8-08 ROD remains protective of human health and the environment after completion of the field work activities. The ICP has been revised to address appropriate information from the recently issued U.S. EPA Region 10 final policy on the Use of Institutional Controls at Federal Facilities; the revised ICP is included in this RD/RA-II Work Plan as Appendix D. The ICP also includes modifications to the OU 8-05/06 institutional controls that were defined in the OU 8-05/06 Work Plan, to reflect the new EPA policy. The institutional controls that will be implemented for OU 8-08 sites of concern are summarized below.

During the time that the NRF properties are controlled by the Department of Energy, current institutional controls (i.e., fencing, security controlled access, and administrative controls on land use) will be maintained. NRF prohibits unauthorized or accidental excavation in these areas using a combination of training and procedural requirements. NRF restricts unauthorized entry by fencing, warning signs, and controlled access via security personnel. The ICP provides details concerning the requirements at these sites after performance of the remedial actions. The institutional controls will be reviewed yearly as part of the Institutional Control Monitoring Report, and every five years as part of the required five year CERCLA review, and will be updated as necessary.

4.0 Final Design

This section provides the final design for the work projects identified above. The specific actions, which will be taken to implement the selected remedy for the designated NRF sites, are summarized in this section. The specific details of the construction portion of the selected remedy will be relayed to the construction contractor via the technical specifications.

4.1 Engineered Cover

The controlling elements in the design of the engineered cover include providing a barrier to prevent exposure to and direct contact with contaminated soil, limiting biotic intrusion, limiting infiltration, and providing erosion control. Therefore, the design criteria for the engineered cover includes: (1) appropriate soils that minimize erosion, with properties that will also limit infiltration for the specific layers of the cover that are proposed; (2) a sufficient thickness of soil for adequate water storage to further limit infiltration; (3) appropriate material and thickness to provide a barrier that will prevent exposure and direct contact with the contaminated soil by any individual and also inhibit biotic intrusion; and (4) appropriate slope, to provide adequate drainage. The surface of the three designated leaching bed/pit areas and the old sewage basin area will be filled and compacted with an appropriate base soil material, especially in areas of subsidence and over the soft-sided container storage areas. The surfaces will be contoured to have a 3-5% top slope with a maximum 3 horizontal to 1 vertical slope contour for the side slope (where the edges will meet with the surrounding natural surfaces) or, where possible, the edges will be tucked in to the adjoining natural surrounding surface. The cover that will be placed on each of the designated areas will consist basically of a three-layer configuration; each layer will be constructed with the slope contours as described above. The cover will then be seeded with native plants, to provide a vegetative cover to enhance evapotranspiration and limit infiltration. The selection process of the final cover design (based on an INEEL study and modeling results) and the design details are discussed in the following sections.

4.1.1 INEEL Study of Alternative Evapotranspiration Covers

The INEEL study of alternative evapotranspiration caps (Anderson and Forman, 2002) was essentially based on the inappropriateness of the EPA recommended traditional RCRA cover (a multi-layered cover with a low hydraulic conductivity geomembrane/soil layer based on EPA guidelines (EPA, 1989) for implementation of waste disposal regulations in RCRA under 40 CFR Part 264 for landfills) in arid and semi-arid climates, and the need for an alternative cover design(s) for these types of climates. Concerns with traditional RCRA cover performance in semi-arid areas were also observed at a site located in a semi-arid area where a traditional multi-layered RCRA cover was installed (Dutta, 1993). Under arid conditions, water evaporation potential greatly exceeds the amounts of water received as precipitation. To preclude significant infiltrating water from reaching buried contaminants, which potentially could mobilize the contaminants, the water must be stored above the contaminated zone until it can evaporate. In the alternative cover designs of this study, the soil serves as a reservoir that temporarily stores water from precipitation that is not immediately evaporated. The plants on the cover extract the water from the soil and return it to the atmosphere. Thus, the soil and plants in combination are the main components of what is known as an "evapotranspiration (ET) cover." For this type of cover to be successful, the soil layer within the cover must be of sufficient thickness to store water from precipitation while plants are dormant or from heavy precipitation events. A healthy stand of perennial plants that are capable of depleting the storage reservoir is also crucial.

The INEEL cover study evaluated the performance of four different cover designs: a soil-only cover, a shallow biobarrier cover, a deep biobarrier cover, and an EPA RCRA cover. Concerns over small mammals or burrowing insects compromising the performance of a soil-only cover prompted the INEEL cover study to investigate the placement and performance issues of a biotic intrusion or biobarrier layer within the cover. Other studies recommend that a biobarrier consisting of a layer of rock placed within the ET soil cover would restrict plant root intrusion and the depth that small mammals could burrow (Reynolds, 1990, Pratt, 2000). Another study recommended that a biobarrier consisting of a cobble layer sandwiched between two layers of gravel placed within the ET soil cover would obstruct tunneling into the contaminated soil by ants (Johnson and Blom, 1997). Another issue that the INEEL cover study investigated was the concern whether the biobarrier might constrain the growth of plant roots and impact the effective water storage reservoir of the soil cover. Based on this concern, the placement of the biobarrier at a certain depth within the soil cover profile is crucial. Therefore, the INEEL cover study investigated the placement of the biobarrier at different depths within the ET soil cover. One design (the shallow biobarrier cover) placed the biobarrier at a shallow depth and another design (the deep biobarrier cover) at a depth two times as deep as the shallow depth. Other studies conducted at the INEEL reported that 2 meters was the maximum observed depth of small mammals and harvester ants (Laundre 1989, Laundre and Reynolds 1993, Pratt 2000). To investigate the effects of climatic changes, namely increased precipitation, on the soil cover designs, the cover study included two supplemental irrigation treatments in addition to the evaluation of an ambient precipitation control. Each supplemental treatment in combination with the ambient precipitation essentially doubles the average ambient precipitation. The amount of supplemental irrigation treatment is more than that predicted by climate change models. These treatments were applied on the covers to simulate two separate precipitation events (increased summer and winter/spring precipitation events). Finally, the cover study evaluated the establishment and development of a community of native plant species and compared the performance of the ET cover with these species to that of a cover with only a monoculture of crested wheatgrass.

The following provides the recommendations from this study for a cover configuration. The study demonstrated that under ambient and even large increases in summer precipitation, cover performance was not adversely affected for all four cover designs supporting a healthy community of drought-tolerant perennial plants. However, with increases in winter/spring precipitation, cover performance was adversely affected for the EPA RCRA cover in that the cover did not have adequate water storage capacity to accommodate increases in winter/spring precipitation and occasional water drainage off of the flexible membrane liner was observed. The soil-only and the biobarrier cover designs were more effective in storing increases in winter/spring precipitation. In addition, the soil-only and the biobarrier covers were capable of storing and removing moisture to the atmosphere (via evapotranspiration) in greater quantities than predicted under current climate change scenarios. Overall, based on all the results from this cover study, the researchers recommend two cap configurations: a soil-only cover that consists of a 2 meter (or about 6.5 ft) depth of a relatively homogeneous soil, or a soil/biobarrier cover that consists of a 1.2 meter (or about 4 ft) depth of a relatively homogeneous soil overlying a 0.5 meter (or about 1.5 ft) gravel/cobble biobarrier. Both of these cover configurations are able to prevent percolating water from reaching the contaminated soil so long as they are capable of supporting a healthy community of drought-tolerant perennial plants. In addition, both configurations can deter burrowing animals (including ants) from reaching the contaminated soil. The disadvantage of the 2 meter soil-only cover, relative to the soil/biobarrier cover, is the greater amount of soil that is required. An added benefit of the soil/biobarrier cover is that, since the soil/biobarrier cover contains a gravel/cobble layer, a capillary break exists between the fine textured soil and the gravel at the top of the biobarrier. Because of this capillary break, water content of the fine textured soil above the biobarrier must approach saturation before water will percolate through, thus maximizing the amount of water stored in the fine textured soil. Furthermore, this biobarrier cover configuration should better prevent burrowing by animals, including insects, which is the primary function of this layer. A gravel mulch (a topsoil/gravel admixture) will be applied to the cover surface to retard excessive surface evaporation (to enhance seedling establishment and promote continued plant growth) and primarily, to reduce erosion.

Recommendations for plant species for the vegetative cover included a variety of shrubs, perennial grasses, and perennial forbs. The list for shrubs included sagebrush and green rabbit brush. The list for perennial grasses included streambank wheatgrass, bluebunch wheatgrass, and great basin wild rye. The list for forbs included northern sweetvetch, tapertip hawksbeard, and scarlet globe-mallow.

4.1.2 Engineered Cover Modeling

The final cover design was evaluated using the Hydrologic Evaluation of Landfill Performance (HELP) software program. The HELP model is a screening tool that may be used to compare the leachate production potential of the engineered cover design configurations under consideration (EPA, 1994). The HELP model was used to estimate the infiltration rate into the proposed NRF engineered cover areas using site specific soil data and local meteorological data from the National Oceanic and Atmospheric Administration (NOAA) for the INEEL. A more complete description of the model and an explanation of the assumptions used and results are included in Appendix F.

One of the specific relevant and appropriate requirements (40 CFR 264.310) for post-closure care states that the cover must "have a permeability less than or equal to the permeability of any ... natural subsoils present." To determine the maximum acceptable permeability (or hydraulic conductivity) for a cover, existing soil data from representative NRF soils, and other documentation for the INEEL, were evaluated. A hydraulic conductivity value was then derived and used for the purpose of modeling the proposed cover design.

Locally available saturated hydraulic conductivities, determined from a limited number of native soil samples taken from areas north of NRF during previous investigations, were evaluated. The depth and the types of soils from which the hydraulic conductivity values were derived, were noted. The saturated hydraulic conductivities determined from natural subsurface soil samples taken from areas north of NRF ranged from 1.2×10^{-7} to 1.7×10^{-4}cm/sec (WEC, 1995). Saturated hydraulic conductivities taken during the OU 8-05/06 landfill cover remedial action of the subsoils under the waste layer from three different sites ranged from 1.9×10^{-2} to 2.4×10^{-1} cm/sec for five of the seven samples taken, with the other two samples having hydraulic conductivities of $3.4x10^{-6}$ and $3.7x10^{-7}$ cm/sec. One of the landfill cover areas, NRF-51, addressed in the OU 8-05/06 remedial action is adjacent to NRF-19. Therefore, the hydraulic conductivity of the subsoils for these two sites should be similar. Samples collected from boreholes adjacent to NRF-14 and NRF-12B showed very little migration of contaminants in the upper 20 feet of soil. Additional boreholes were drilled to the basalt adjacent to NRF-14 and NRF-19 where historic perched water layers existed above the basalt and did not indicate the presence of a current perched water body. Only small amounts of contaminants (below the cleanup levels) were found in these boreholes. These boreholes also revealed that a silty clay layer exists underneath the NRF-14/12B area at around the 24-foot depth. These data indicate that the soil directly beneath the contaminant layer is alluvium. The extent of contamination at the A1W Leaching Bed is limited to the soil within and directly below the leaching bed. Very little migration of the contaminants was found. The majority of the contamination (above cleanup levels) is concentrated within the 5 to 7 foot depth of the bed (from pre-RI sampling). The depth to basalt ranges from about 10 ft at the center of the bed to 15 ft or more around the periphery. There were no indications that a significant silty clay layer exists on top of the basalt at this site. The extent of contamination at NRF-21A is estimated to be a two foot layer of soil at the bottom of the basin. Depth to contamination around the edges is generally 5 to 6 feet in the original basin, and about 8 feet in the expanded basin. Depth to contamination is about 11 to 12 feet in the center of original basin and 10 to 11 feet in the center of the expanded basin. The trench investigation along with other excavation/removal activities conducted at NRF-21A during the Phase I Remedial Action indicated that at least one foot of soil below the contamination layer at this site is alluvium. However, to verify that the soil directly beneath the contamination layer is alluvium, three boreholes to the basalt will be drilled around the periphery at each site. Samples will be taken of the soil that is representative of the soil directly beneath the contamination layer.

Only limited hydraulic conductivity values are available for the alluvial soil underlying the loess at the INEEL. The alluvium typically consists of gravel and sand with lesser amounts of silt and clay. Saturated hydraulic conductivities of loess and subsurface alluvial soils determined from undisturbed soil samples collected at the Radioactive Waste Management Complex (RWMC), another site within the INEEL located south of NRF, ranged from $4.4x10^{-4}$ cm/sec to $5.5x10^{-3}$ cm/sec at depths between 1 to 8 feet (WEC, 1995). The soil samples taken from a continuous core were described as being clayey silt to sandy silt. The source material for the subsurface soils at the RWMC and NRF is expected to be the same since soil sample data from both sites were consistent with soil sample data from the Big Lost River Basin (USGS, 1994). From previous studies, borehole data indicate that the soil underlying the contaminant zone at the four sites to be capped is known to be alluvium. Source materials for the engineered covers that were placed at three different inactive landfill sites for the 8-05/06 remedial action exhibited hydraulic conductivity on the average of $2.8x10^{-5}$ cm/sec (WEC, 1997). Therefore, based on the existing data and documentation discussed above, a hydraulic conductivity value of $1x10^{-5}$ cm/sec was derived and used to model the proposed cover design.

In modeling the NRF engineered covers using the HELP model, only one of the two recommended designs from the above INEEL cover study, the deep biobarrier design, was evaluated. The proposed engineered cover modeled consisted of the following configuration: a vegetative top soil layer, a subsurface soil layer, a biobarrier layer, a pre-existing soil cover (only for NRF-21A, which has a significant pre-existing soil cover), and a contaminant layer. In practice, the other sites will also have a clean soil layer between the biobarrier and the underlying contamination, but not as thick as at NRF-21A. All of the layers were conservatively modeled as vertical percolation layers with the exception of the biobarrier layer, which was modeled as a drainage layer. The vegetative topsoil layer was assumed to be 6 inches thick with a hydraulic conductivity of $1x10^{-4}$ cm/sec. The underlying soil layer was assumed to be 4 feet thick with a hydraulic conductivity of $1.0x10^{-5}$ cm/sec. The biobarrier layer was assumed to be 1.5 feet thick. The pre-existing soil layer for NRF-21A was assumed to be an average of 4 feet thick with a hydraulic conductivity of

1.0×10^{-5} cm/sec. Each site was modeled using the site-specific surface area and contaminant layer thicknesses. The hydraulic conductivity for the contaminant layer was assumed to be 1.0×10^{-3} cm/sec (typical of gravel/sandy soils where contamination has been observed). Average monthly temperature data for 20 years were used. The model requires a minimum of 5 years of precipitation data; however, 50 years of complete and available precipitation data for the INEEL were selected for use in the HELP model to obtain a more representative precipitation average. The cover was modeled as having a fair stand of grass for a vegetative cover.

Two precipitation cases were modeled. The first case was modeled using INEEL Central Facilities Area (CFA) precipitation data over a 50 year period as recorded by NOAA. An average annual precipitation value of 8.68 inches was derived from this data. A simulation time period of 100 years was used for the first case to calculate leachate production. The second case was modeled using precipitation data for a hypothetical maximum wet period. The average annual precipitation used for modeling the maximum wet period is 17.36 inches over a ten year simulation period. The maximum wet period amount used for the model is double the average annual precipitation value and is nearly the same (16.7 inches) as that used to model the NRF inactive landfill covers (OU 8-05/6; WEC, 1995). Furthermore, this amount is slightly greater than that used in the INEEL cover study. As previously discussed in the INEEL cover study section, the study report stated that this amount of precipitation is much greater than that predicted by the climate change models. In addition to these two precipitation scenarios, a peak day precipitation event (the maximum precipitation received in a 24-hour period) for both cases was modeled. The estimated leachate quantities for both cases are presented in Table 4-1.

The modeling results presented in Table 4-1, based on the data used for input and the conservative assumptions made, indicate that infiltration into the contaminant layer using the proposed biobarrier cover design produces none to negligible amounts of leachate. Therefore, this design as modeled is anticipated to meet the desired criteria in minimizing the migration of liquids at all four sites to be covered at this time.

4.1.3 Site Preparations

An engineering survey shall be conducted to define the cover perimeter at each area. The exact area to be encompassed by the engineered cover shall be clearly delineated with visible markers (e.g., survey stakes).

To verify that the hydraulic conductivity of the entire soil layer directly beneath the contamination layer is greater than or equal to the proposed hydraulic conductivity of the engineered cover (1.0×10^{-5} cm/sec), three boreholes to the basalt will be drilled around the periphery at each site prior to the construction of the engineered covers. The anticipated target depths of the natural soils beneath the contamination layer are approximately the 18-20 foot depth at NRF-14/12B, 14-16 foot depth at NRF-21A, and 8-10 foot depth at NRF-19. A portable drilling rig with a split spoon sampler will be used to obtain samples. Samples will be analyzed for hydraulic conductivity by ASTM Method 5084 (for tight soils) or the hazen equation (for alluvium samples) and, if required, for particle size distribution (for alluvium samples). Borehole and site excavation soil data collected to date indicate that the soil directly beneath the contamination layer at these sites is alluvium, which has had observed hydraulic conductivities between 1.9×10^{-2} to 2.4×10^{-1} cm/sec at other NRF locations.

Table 4-1. Estimated Leachate Quantities Generated by the Proposed Cover Design using the HELP Model

Site	Average Precipitation Period				Wet Precipitation Period			
	Average Annual[a] Leachate Production (gal/yr)		Peak Day[b] Leachate Production (gal/day)		Average Annual[a] Leachate Production (gal/yr)		Peak Day[b] Leachate Production (gal/day)	
	Initial soil Moisture Case 1[c]	Initial soil Moisture Case 2[d]	Initial soil Moisture Case 1[c]	Initial soil Moisture Case 2[d]	Initial soil Moisture Case 1[c]	Initial soil Moisture Case 2[d]	Initial soil Moisture Case 1[c]	Initial soil Moisture Case 2[d]
NRF-19	0	174.9	0	7.27	26.4	411.4	6.5	13.8
NRF-21A	0	441.8	0	18.4	0.42	1667	4.2	31.7
NRF-14 & 12B	0	996	0	41.7	5.8	519.5	5.8	67.3

Notes:

a. Based on annual precipitation

b. Based on peak day precipitation

c. Initial soil moisture above the Wilting Point based on actual maximum soil moisture contents detected in the soils for the INEEL ET cover study (case 1)

d. Initial soil moisture model input based on model derived soil moisture values for each layer, modeled for approximating a steady-state condition (case 2)

e. The difference in leachate production between the wet and dry (i.e., "average") precipitation scenarios is due to the length of the simulation period (10 years for the wet versus 100 years for the dry). Leachate production during the 100-year dry scenario initially increases with time, leveling off at about the 30-year point, causing a higher per-year leachate when averaging over the 100-year scenario. The wet precipitation scenario does not reach the higher steady state range (as in the case for the dry scenario); therefore per-year average leachate production is relatively low. Running the wet simulation for 100 years (and attaining steady state) would be unrealistic, because a drastic change in climatic conditions would be required for such a duration.

Areas with pre-existing natural soil cover will first be modified by clearing away any vegetation within the cover area, followed by filling and compaction of any areas that contain pits, cavities, or any other type of depressions that may be an indication of subsidence. These surface features exist particularly at NRF-14 and NRF-12B, which include the soft-sided container storage areas. The asphalt cover currently over NR12B will be broken up and removed off-site away from NRF. The asphalt removed will be characterized, packaged, and disposed of per the Waste Management Plan. Existing fencing at NRF-14/12B area and at NRF-19 shall be removed. Site preparations at NRF-21A will include leveling the remaining 3 foot mounded area to the surrounding grade, backfilling/compaction of the 5 foot depression, and the removal of debris (consisting mostly of roofing material) within the mounded area. The debris will be disposed of per the Waste Management Plan.

Any area that requires additional fill material and compaction to repair surface features will undergo a geotechnical evaluation to ensure that these areas have sufficient load bearing capacity. The geotechnical evaluation will include an inspection of the soil material to be used as fill (to ensure that the material is free of debris) and the inclusion of compaction tests to ensure that the areas have been properly compacted. The final site preparation step is placement of a base material (clean pit run gravel with particle size less than 3 inches) over the entire proposed cover area (including the areas that did not require repair of surface features) to serve as a base layer. The surface of this layer will be contoured to obtain a 3-5% top slope and have a minimum depth of one foot. These site preparations will help minimize subsidence of the cover, and the base layer will serve as a support base providing stability for the upper three soil layers of the engineered cover.

4.1.4 Engineered Cover Design Specifics

The engineered cover design that will meet the desired criteria stated previously based on modeling results (from the HELP model) and the INEEL cover study, consists of three components: a top soil layer for the vegetative cover, a subsurface soil layer (for water storage purposes), and a biobarrier layer. The engineered cover layers, beginning with the biobarrier layer, will be placed on top of a base support layer (Section 4.1.3). The engineered cover will be placed in accordance with the technical specifications provided to the construction contractor. These technical specifications will be based on the design parameters provided herein. Soil material testing requirements (specific tests to be performed as well as the frequency) will also be included in the technical specifications. Quality assurance for the placement of the covers will be dictated by the Construction Quality Assurance Plan included in Appendix I. The potential borrow sources at the INEEL identified for this project for the underlying soil layer are Spreading Area A by the Radioactive Waste Management Complex and Rye Grass Flats near the Power Burst Facility. Soil material property tests have been conducted for these borrow sources and pertinent results are included in Section 4.1.4.4. Additional material testing requirements for the final borrow sources identified for this project will be included in the technical specifications as verification information to ensure that these borrow sources are indeed appropriate for this project. The proposed cover design configuration is illustrated in Figure 5.

Since NRF is in an arid climate, the drainage layer typical of most landfill cover designs is not required as discussed in the EPA guidance landfill cover design manual (EPA, 1989) and as shown by HELP model results (as evidenced by minimal leachate production due to negligible infiltration into the contaminant layer). The individual layers for the proposed engineered cover are discussed in more detail below.

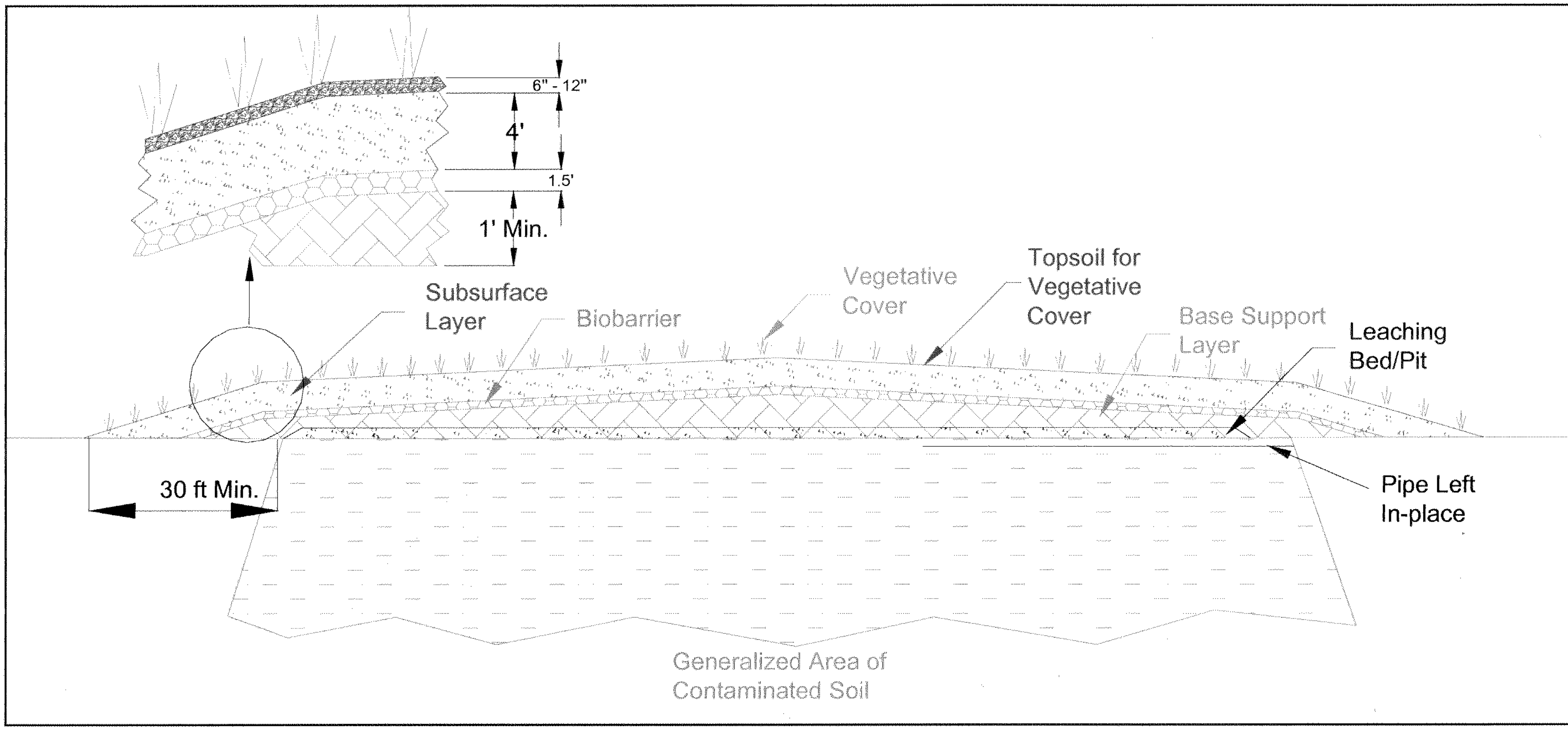

Figure 5. Proposed Engineered Cover Configuration

4.1.4.1 Top Layer

The top layer of the cover serves to promote runoff and inhibit erosion. The top layer consists of two components:

- Surface cover (a vegetative cover for this design)
- Underlying topsoil.

The surface of the top layer will have a 3-5% top slope and a maximum 3 horizontal to 1 vertical slope contour (side slope) to promote surface runoff.

The vegetative cover will serve to inhibit erosion and promote evapotranspiration (limits water infiltration). This cover will consist of indigenous vegetation (perennial plants) with the following characteristics:

- Resistance to drought and temperature extremes
- Roots that will not significantly disrupt the subsurface soil layer
- Ability to thrive in low-nutrient soil with minimal nutrient additions
- Sufficient density to minimize cover soil erosion (target: no more than 2 tons/acre/year, calculated using the U.S. Department of Agriculture Universal Soil Loss Equation (EPA, 1991))
- Ability to survive and function with little or no maintenance.

The plant mixture that closely matches the above characteristics has been evaluated from vegetation studies conducted at the INEEL and from the plant mixture that was used for the three NRF inactive landfill covers at OU 8-05/6. The plant mixture that was selected for the covers consists of at least three types of perennial grasses (bluebunch wheatgrass, great basin wild rye, and streambank wheatgrass), at least two types of shrubs (sagebrush and rabbitbrush), and at least two perennial forbs (northern sweetvetch and scarlet globe-mallow). These species are indigenous to the area. This mixture is slightly different from that used for the NRF inactive landfill covers since the selected mixture is based on long-term vegetation data from study plots at the INEEL, which indicated that areas having a community of indigenous plants with more species tend to maintain higher cover density and fluctuate less in cover density compared with areas that support fewer species (Anderson and Inouye, 2001). Since the plant mixture selected for the vegetative cover consists only of native species, once established the vegetative cover should be able to survive and function with little or no maintenance.

The growth of vegetation on the cover results in root intrusion through the cover. The only potential effect on the cover by root intrusion is when the vegetation dies and the roots decay, leaving voids that can increase infiltration (DOE-AL, 1995). However, by the use of native drought tolerant plant species, this effect is minimized. Even though the INEEL ET Cover Study addressed the fact that roots from native plants did penetrate the underlying soil layer of the covers tested, the underlying soil layer did perform effectively as a water storage unit with sufficient capacity to store water even under wet precipitation scenarios.

The function of the soil component of the top layer is to support a vegetative cover, inhibit erosion, and have a top slope that promotes drainage. There is no specific permeability requirement for this soil. The design characteristics for this layer are as follows:

- 6 to 12 inches of topsoil to support vegetation
- A soil/gravel admixture (for supporting seed germination, root development, and minimizing surface erosion)
- A final top slope, after allowance for some settling and subsidence, between 3% and 5%

- Minimal compaction, to support root development and to provide sufficient infiltration to maintain plant growth during dry periods.

4.1.4.2 Subsurface Layer

The main function of the subsurface layer is to provide adequate water storage to further limit water infiltration. The INEEL cover studies (ESRF, 1999) demonstrated that for a cover design that incorporates a biobarrier, a minimum subsurface soil cover thickness of 4 feet above the biobarrier would be adequate for water storage. The soil type to be used for the subsurface layer will be within the loam to silty clay class. These types of soil are readily available from borrow sources at the INEEL. A silty clay loam was used in the INEEL ET cover study. The particle size distribution of the soil used in the INEEL ET cover study, on average, was 19% sand, 48% silt, and 33% clay. The soil material for the proposed cover must have a permeability or hydraulic conductivity less than or equal to the surrounding natural subsurface soils per 40 CFR 264.310. The HELP model confirmed that for the various precipitation scenarios modeled, the specified thickness and hydraulic conductivity identified below are adequate for this layer (i.e., no leachate production for normal precipitation and low leachate production rates for wet precipitation scenario). The soil will be placed in 6 to 8 inch lifts and moderately compacted (a minimum compaction of 95% of maximum density at optimum moisture content) to minimize the problem of settling and subsidence. This minimum compaction value may be revised based on hydraulic conductivity testing (the minimum compaction value shall result in a hydraulic conductivity of no more than $1x10^{-5}$ cm/sec) to be conducted once a borrow source is identified for this project.

This layer will consist of only a soil component with the following characteristics:

- A minimum of four feet of moderately compacted soil with in-place saturated hydraulic conductivity less than or equal to $1x10^{-5}$ cm/sec, to provide adequate soil moisture storage capacity to limit water infiltration
- Free of clods, large rocks and stone, debris, etc.
- A minimum surface slope of 3% with a maximum slope of 5%.

4.1.4.3 Biobarrier Layer

The function of the biobarrier layer is to inhibit biotic intrusion by plants, burrowing animals, and individuals. This layer also functions as a capillary break that utilizes differences in pore size and capillary forces, under unsaturated conditions, to retain water in the subsurface layer discussed above. The recommended characteristics for the biobarrier layer are as follows, based on the INEEL studies and HELP model:

- Overall minimum thickness of 1.5 feet
- Cobble layer about 1 foot thick sandwiched between two gravel layers that are each about 4 inches thick; particle size for cobble: from 3 to 6 inch diameter; particle size for gravel: from No. 8 sieve to ¾ inch diameter (particle sizes per Anderson and Forman, 2002 and DOE-ID, 2002)
- A minimum surface slope of 3% with a maximum slope of 5%.

4.1.4.4 Borrow Sources for the Engineered Covers

The borrow material required for the subsurface layer will be available from INEEL at one of two potential sources or as assigned by the INEEL Borrow Source Manager. These borrow locations are the Rye Grass Flats near the Power Burst Facility or Spreading Area A near the Radioactive Waste Management Complex. Available soil material test results for these locations are listed in Table 4-2. The gravel and cobble required for the biobarrier layer will be obtained by the

Table 4-2. Borrow Source Test Results

Sample	Material Description	% Gravel	% Sand	% Silt	% Clay	Max. Dry Density (lbs/ft^3)	Optimum Moisture %	Liquid Limit	Plastic Limit	Hydraulic Conductivity cm/sec
Rye Grass Flats										
1	Lean Clay (CL)	0.1	7.0	51.6	40.3	106	18	33	18	5.23E-08 Compaction: 98.2% Moisture Content: 16.3%
2	Lean Clay (CL)	0	7.4	43.6	49	105	20	33	16	3.02E-07 Compaction: 98.8% Moisture Content: 20.8%
3(1)	Lean Clay (CL) w/sand	0	22.1	44.6	33.3	111	16	28	18	NA
4	Lean Clay (CL)	0.3	5.7	47.3	46.7	107.	19	38	17	NA
5	Lean Clay (CL)	0	7.1	37.5	55.4	104	19	44	16	1.4E-07 Compaction: 98.6% Moisture Content: 18.1%
6	Lean Clay (CL)	0.3	4.4	39.4	55.9	110	20	36	19	2.55E-06 Compaction: 97.5% Moisture Content: 14.7%
Spreading Area A										
1	Silty Clay Loam (CL)	0	9.4	59.7	30.9	NA	NA	28	9	2.06E-7 Compaction: 97.8% Moisture Content: 19.7%
2	Silt Loam (CL)	0	10.8	71.7	17.5	NA	NA	31	15	2.31E-6 Compaction: 96.4% Moisture Content: 13.3%
3	Silt Loam (CL-ML)	0	9.4	64.2	26.4	NA	NA	25	7	7.9E-8 Compaction: 97.8% Moisture Content: 20%

(1) This soil material is similar to the soil material used in the INEEL ET Cover study which consisted on average of 19% sand, 48% silt, and 33% clay

subcontractor from an off-site, commercial vendor. Borrow operations and additional borrow material testing for verification purposes will be performed in accordance with the project technical specifications.

4.2 Monitoring Activities

4.2.1 Surface Soil and Moisture Monitoring

Surface soil and moisture monitoring will be performed after the engineered cover has been placed at each location, to assess the effectiveness of the cover in preventing the release of contaminants. Surface soil monitoring will consist of radiological surveys over the cover, and the collection of soil and vegetation samples for analysis. Soil moisture monitoring will consist of a survey with a neutron probe conducted via subsurface access tubes located within the cover area. From these measurements, a determination can be made on how deep percolating water has penetrated the cover. Figure 6 depicts the design of the access tubes. Access tube construction will consist of 2 inch ID steel casing penetrated down to the support base layer of the covers, a lockable cap, and a concrete pad. Details of the surface soil and moisture monitoring (including the specific analyses to be performed on soil and vegetation samples) are included in the O&M Plan (Appendix C). The O&M Plan also includes the locations of the planned access tubes.

4.2.2 Groundwater Monitoring

The NRF site-wide groundwater monitoring program will be modified to assess the effectiveness of the engineered covers at mitigating potential releases to the aquifer. The Facility-wide Groundwater Monitoring Program will be modified to accommodate additional groundwater monitoring requirements for the designated OU 8-08 areas as specified in the O&M Plan (Appendix C). Groundwater data (e.g., analytical, water level, temperature, and pH measurements) will be obtained from monitoring wells upgradient and downgradient of the three covered areas. The monitoring well locations are identified in the O&M Plan.

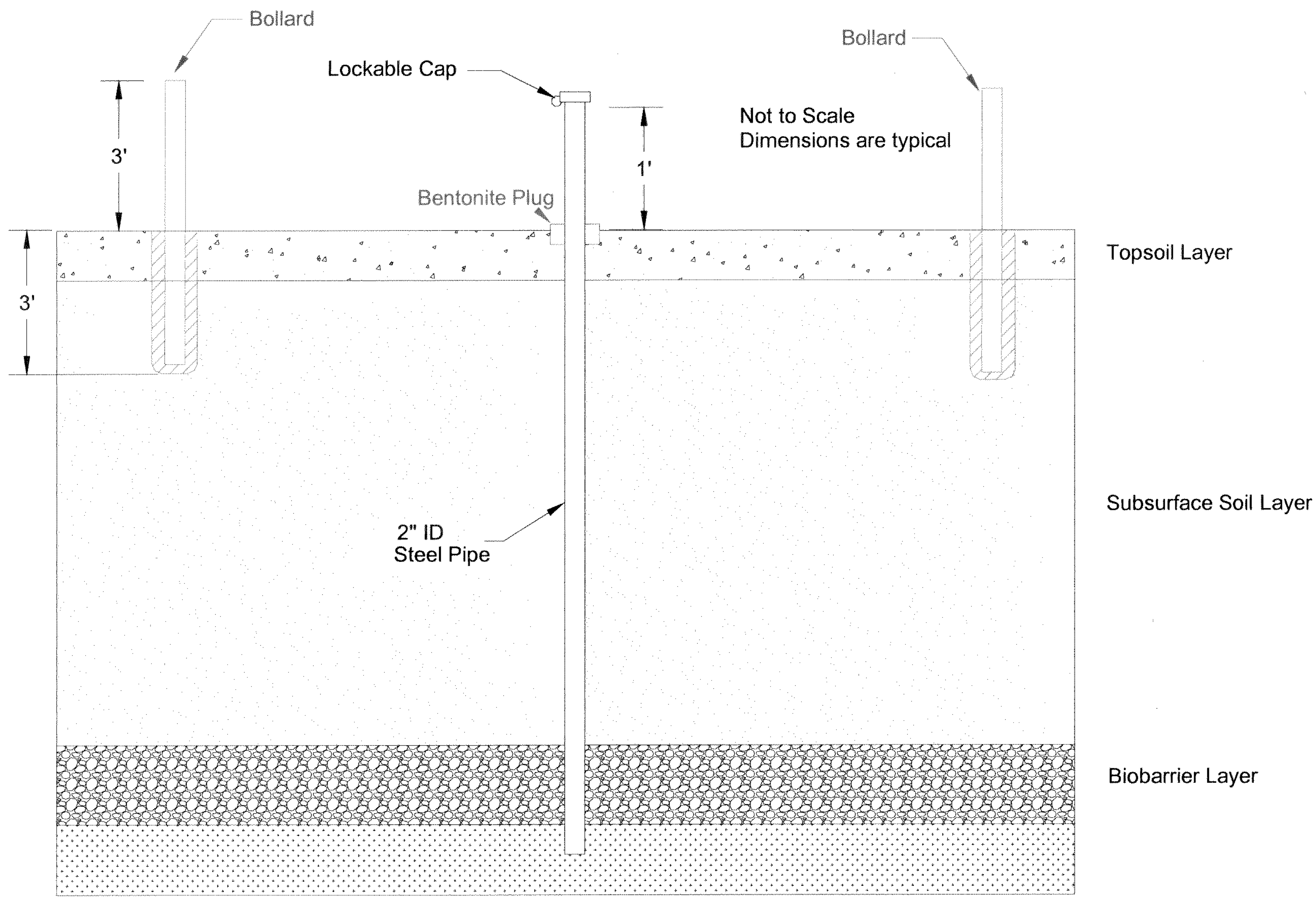

Figure 6. Neutron Probe Access Tube Configuration

5.0 Performance Goals

Specific performance goals were established in the OU 8-08 ROD for the engineered covers. These performance goals will be used for the Phase II remedial actions.

- Installation of covers that are designed to discourage any individual from inadvertently intruding into the contaminated soil, or from contacting the contaminated soil at any time after active institutional controls over the sites are removed, up to the design life of the covers.
- Application of maintenance and surface monitoring programs capable of providing early warning of releases of radionuclides from the sites, before they leave the site boundary.
- Institution of restrictions limiting land use to industrial applications for at least 100 years.
- Implementation of surface water controls to direct surface water away from the contaminated soil.
- Elimination, to the extent practicable, of the need for ongoing active maintenance of the sites following closure, so that only surveillance, monitoring, or minor custodial care are required.
- Placement of adequate cover to inhibit erosion by natural processes for the specified design life (365 years) of the cap.
- Incorporation of features to inhibit biotic intrusion into the contaminated soil areas.

The layered system design and thickness of the cover along with the materials used will be beneficial in discouraging inadvertent human intrusion or inadvertent future contact with the contaminated soil. The design criteria for the cover includes: the selection of soils and indigenous plants that have properties to limit erosion and infiltration; the determination of the cover thickness sufficient for adequate water storage to limit infiltration; the determination of a slope that provides adequate surface drainage to offset potential subsidence areas and flat spots; and the incorporation of a biobarrier with properties that inhibit biotic intrusion by plants or animals. The use of indigenous plants and the use of cover materials as specified (including the use of native soils), when properly placed (in the specified mixture/texture and compacted as required), will minimize the need for maintenance.

Specific requirements to maintain cover integrity against erosion, and to monitor for the potential release of contaminants from the sites, are identified in the O&M Plan. Institutional controls for limiting land use and access are addressed in the ICP.

6.0 Regulatory Requirements (Applicable or Relevant and Appropriate Requirements)

Remedial actions conducted entirely on-site under CERCLA are exempt from obtaining Federal, State, or local permits per CERCLA Section 121. However, these actions must comply with the substantive aspects of the applicable or relevant and appropriate requirements (ARARs) specified for the identified sites. Therefore, the work tasks associated with the Phase II Remedial Action to be performed at the identified sites of concern will meet all Federal and State ARARs. The specific work tasks identified for the Phase II Remedial Action are the placement of engineered covers over the identified sites and site monitoring activities addressed in the O&M Plan.

The ARARs that have been identified for the Phase II Remedial Action work projects fall under three categories: location-specific, action-specific, and chemical-specific. The specific work tasks for this remedial action will be designed to comply with all three types of ARARs. The specific ARARs associated with the Phase II work tasks as they apply to each site and compliance strategy are presented in Table 6-1. To be considered (TBC) requirements have also been identified for the Phase II Remedial Action and are presented in Table 6-2. The ARARs and TBCs included in the following tables are those identified in the ROD.

Table 6-1. ARAR List for Phase II Remedial Action

ARARs for Phase II Remedial Action	Specific Requirement(s)	Relevancy & Specific-Site(s) Affected	Compliance Strategy
40 CFR 61.92 NESHAPS for Emissions of Radionuclides Other than Radon	Emissions of radionuclides to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of ≥10 mrem/yr	Applicable to radionuclides detected at NRF-12B, NRF-14, NRF-19, NRF-21A	No excavation or any type of disturbance of the buried contaminated soil is currently planned for any of these three sites under Phase II. If any excavation activities occur, then the compliance strategy given in the Phase I RD/RA Work Plan will be followed.
IDAPA 16.01.01.585 & .586[(1)] Toxic Substances	Screening emission levels and acceptable ambient air concentrations for carcinogens and non-carcinogens shall not be exceeded	Applicable to sites where carcinogenic and non-carcinogenic substances have been detected and the work activities have the potential for their release into the air.	There are several contaminants detected during the RI/FS sampling that typically require a screening emission level. However, no excavation or any type of disturbance of the buried contaminated soil is currently planned for any of these four sites under Phase II. If any excavation activities occur, then the compliance strategy given in the Phase I RD/RA Work Plan will be followed. Emission calculations included in the Phase I Work Plan (based on very conservative scenarios) are valid since the work areas for Phase II are smaller.
IDAPA 16.01.11.200.01(a)[(1)] Idaho Groundwater Quality Rule	Protect groundwater and demonstrate that the water quality standards in the Idaho Groundwater Quality Rule will be met.	Relevant & Appropriate for sites NRF-12B, NRF-14, NRF-21A and NRF-19.	The contaminants of concern are Sr-90, Cs-137, and lead (for NRF-12B only). Computer modeling indicates that the probability for contaminant migration to the aquifer is relatively low. However, during the operation and maintenance period, groundwater monitoring will be performed to verify that contaminant migration has not occurred.
IDAPA 16.01.05.006.01[(1)] (40 CFR 262.11) Hazardous Waste Determination	A generator of solid waste must determine if that waste is a hazardous waste: • Determine if the waste is excluded under 40 CFR 261.4 • Determine if the waste is listed under 40 CFR 261 Subpart D • Determine whether the waste is identified in 40 CFR 261 Subpart C.	Applicable to work tasks at any site that generate debris type waste.	It is unlikely that significant debris type wastes will be generated during the Phase II remedial action since no excavation of the contaminated soil or any demolition activities are planned; only small amounts of debris (with the exception of asphalt debris from NRF-12B) are anticipated from the removal of current fencing and grubbing activities. Asphalt debris waste

Table 6-1. ARAR List for Phase II Remedial Action (continued)

ARARs for Phase II Remedial Action	Specific Requirement(s)	Relevancy & Specific-Site(s) Affected	Compliance Strategy
	If the waste is determined to be hazardous, the generator will refer to 40 CFR 261, 264, 265, 266, 268 and 273 for possible exclusions or restrictions pertaining to management of the specific waste.		determination will be handled in accordance with the Waste Management Plan.
IDAPA 16.01.05.005[1] (40 CFR 261) Identification and Listing of Hazardous Waste	This part identifies those solid wastes which are subject to regulation as hazardous wastes under parts 262 through 265, 268, and parts 270, 271, and 124 which are subject to the notification requirements of Section 3010 of RCRA.	Applicable to work tasks at any site that generates debris type waste	It is unlikely that significant debris type wastes will be generated during the Phase II remedial action since no excavation of the contaminated soil is planned; only small amounts of debris (with the exception of asphalt debris from NRF-12B) are anticipated from the removal of current fencing and grubbing activities. Asphalt debris will be handled in accordance with the Waste Management Plan.
IDAPA 16.01.05.011[1] (40 CFR 268.7, .9, .40, .45, .48) Land Disposal Restrictions	40 CFR 268.7 - Requirements for waste analysis and record keeping for hazardous waste. 40 CFR 268.9 - Requirements for determination of hazardous waste codes and treatment standards. 40 CFR 268.40 - Provides treatment standards for hazardous waste by hazardous waste code(s). 40 CFR 268.45 - Hazardous debris must be treated prior to land disposal as follows unless EPA determines under 40 CFR 261.3(e)(2) that the debris is no longer contaminated with hazardous waste or the debris is treated to the waste-specific treatment standard provided in this subpart. Table 1 of this subpart provides a listing of alternative treatment standards for hazardous debris. 40 CFR 268.48 - This section provides a table that identifies the hazardous constituents, along with the non-wastewater and wastewater treatment standard levels that are used to regulate most prohibited hazardous wastes with numerical limits.	Applicable to any site where work activities generate hazardous wastes.	It is unlikely that RCRA-listed or characteristic wastes will be encountered during the Phase II remedial action since no excavation of the contaminated soil is planned; however, small amounts of debris (with the exception of asphalt debris from NRF-12B) are anticipated from the removal of current fencing and grubbing activities. Asphalt debris will be handled in accordance with the Waste Management Plan.
40 CFR 300.440 Procedures for Planning and Implementing Off-site Response Actions	This section applies to any remedial or removal action involving the off-site transfer of any hazardous substance, pollutant, or contaminant as defined under CERCLA sections 101 (14) and (33) ("CERCLA waste") that is conducted by EPA, States, private parties, or other Federal agencies, that is Fund-financed and/or is taken pursuant to any CERCLA authority, including cleanups at Federal facilities under section 120 of CERCLA, and cleanups under section 311 of the Clean Water Act.	Applicable to work tasks that involves off-site transfer of CERCLA waste.	It is unlikely that the work tasks at the four sites will involve off-site transfer of CERCLA waste. However, small amounts of debris (with the exception of asphalt debris from NRF-12B) are anticipated from the removal of current fencing and grubbing activities. Asphalt debris will be transferred off-site in accordance with the Waste Management Plan.

Table 6-1. ARAR List for Phase II Remedial Action (continued)

ARARs for Phase II Remedial Action	Specific Requirement(s)	Relevancy & Specific-Site(s) Affected	Compliance Strategy
IDAPA 16.01.01.651 [(1)] Idaho Fugitive Dust Emissions	All reasonable precautions shall be taken to prevent particulate matter from becoming airborne	Applicable to work tasks that involve the likelihood of fugitive dust emissions at: NRF-12B, NRF-14, NRF-19, NRF-21A	Dust suppression measures shall be implemented during the Phase II Remedial Action to minimize fugitive dust generation. These measures can include water sprays, and other work controls, especially during high wind occurrences.
IDAPA 16.01.05.008 [(1)] [40 CFR 264.309(a), 40 CFR 264.310(a)(1)(2)(3)(4)(5), and 40 CFR 264.310(b)(1)(4)(5)(6)] Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities [Specific Appropriate Federal Regulation Sections: Surveying, Closure, and Post Closure Care for Landfills]	At final closure…the owner or operator of a landfill must maintain…in the operating record…(40 CFR 264.309(a)) the exact location and dimensions, including depth, of each cell [containing waste]…with respect to permanently surveyed benchmarks; At final closure…the owner or operator must cover the landfill…with a final cover designed and constructed to...[the requirements under 40 CFR 264.310(a) (1) Provide long-term minimization of migration of liquids through the closed landfill (2) Function with minimum maintenance (3) Promote drainage and minimize erosion or abrasion of the cover (4) Accommodate settling and subsidence so that the cover's integrity is maintained, and (5) Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.]. After final closure, the owner or operator must comply with all post-closure requirements…including maintenance and monitoring throughout the post-closure care period…The owner or operator must [fulfill the maintenance/oversight requirements under 40 CFR 264.310(b) (1) Maintain the integrity and effectiveness of the final cover (4) Maintain and monitor the ground-water monitoring system and comply with applicable requirements of Subpart F of this part (5) Prevent run-on and run-off from eroding or damaging the final cover, and (6) Protect and maintain surveyed benchmarks used in complying with 264.309.]	Relevant & Appropriate for sites NRF-12B, NRF-14, NRF-21A and NRF-19 where contaminants are left in place in significant quantities and that require containment	An engineered cover will be constructed to these requirements at these sites. Each site will be surveyed and permanent benchmarks will be placed as required by 40 CFR 264.309(a). An operation and maintenance plan is included to address maintenance and monitoring requirements. 40 CFR 264.310(a) (1) The use of a native soil cover thick enough for water storage of average and above average rainfall (2) Use of properly compacted native soils and native vegetation (3) Use of a 2-5% slope, gravel mulch and native vegetation (4) Proper compaction of native soils, filling in currently existing depressions (5) Conduct study with the evaluation of available data to determine permeability of subsoils. 40 CFR 264.310(b) (1) Per the O&M Plan, conduct periodic site inspections and perform any repairs as needed (4) Maintenance and monitoring will be accomplished per the O&M Plan, (5) The use of a 2-5% slope to facilitate run-off and adequate drainage away from cover is maintained from areas that may contribute run-on. (6) Use of bollards around

Table 6-1. ARAR List for Phase II Remedial Action (continued)

ARARs for Phase II Remedial Action	Specific Requirement(s)	Relevancy & Specific-Site(s) Affected	Compliance Strategy
			benchmarks for protection and inspections conducted per the O&M Plan.
16 USC 470 National Historic Preservation	The Secretary of the Interior shall promulgate regulations requiring that before any property or district may be included on the National Registry or designated as a National Historic Landmark, the owner or owners of such property,... shall be given the opportunity to concur in, or object to, the nomination of the property or district for such inclusion or designation.	Applicable to any site where cultural, historical artifacts are found. Presently, no evidence of applicability exits for any of the four sites.	The areas that encompass these sites have been investigated and no evidence of historical artifacts was found. However, discovery of any cultural, historical artifacts during the placement of the engineered covers will prompt the termination of any work activity and initiate an evaluation of the site.

(1)-The IDAPA rules identified as the 16 series in the 1998 OU 8-08 Record of Decision, and in this Table for consistency, are in fact referring to what are currently the 58 series rules (reflecting changes within the State of Idaho departmental organization since the time the ROD was signed).

Table 6-2. To Be Considered (TBC) List for Phase II Remedial Action

TBC for Excavation Disposal and Consolidation Phase 1 Activities	Specific Requirement(s)	Specific-Site(s) Affected	Compliance Strategy
DOE Order 5820.2A Chapter III Low-Level Radioactive Waste Management originally cited in the ROD has been cancelled and replaced by DOE Order 435.1 Chapter IV and DOE Manual 435.1-1	DOE Order 5820.2A Chapter IV provided guidance on disposal of low-level radioactive waste at DOE facilities. DOE Order 435.1 Chapter IV provides the requirements for managing and disposal of low-level radioactive waste at DOE facilities. The manual establishes the methods for implementing DOE Order 435.1	NRF-12B, NRF-14, NRF-19, NRF-21A	If radioactive wastes are generated during site clearing activities including radiological personal protective equipment and decontamination water, it will be managed in accordance with the Waste Disposal Plan. Waste material/handling will be minimized by sampling and field screening efforts.
DOE Order 5400.5 Radiation Protection Standards	Provides guidance on radiological environmental protection requirements, cleanup of residual radioactive material, management of waste, and release of property.	NRF-12B, NRF-14, NRF-19, NRF-21A	No excavation activities are planned for these sites. However, site preparation work may encounter some minor radiological surface contamination. Job safety analyses will be performed and radiological controls for the work tasks, if deemed necessary, will be addressed in local procedures.
DOE Order 5480.4 Environmental Protection, Safety and Health Protection Standards	Specifies and provides requirements for the application of mandatory environmental protection, safety, and health standards applicable to all DOE and contractor operations (i.e., facility design, construction, operation, modification, and decommissioning).	NRF-12B, NRF-14, NRF-19, NRF-21A	Job safety analyses and other health related issues will be addressed in the Health and Safety Plan.
Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities	Provides guidance for the management of lead contaminated soil.	NRF-12B	No excavation is currently planned for NRF-12B under Phase II. The contaminated soil, which is not expected to be disturbed under the Phase II activities, is located beneath the asphalt cover.

7.0 Schedule and Deliverables

The schedule for completing the RD/RA process for the OU 8-08 areas, through the point of issuing the RD/RA-II Work Plan, was submitted with the Phase I RD/RA Work Plan. This schedule included the tasks and document preparation for the overall RD/RA process for both the Phase I and Phase II Remedial Actions. A more extensive schedule showing the completion of the Phase II Remedial Action is provided in Appendix G. The only deliverable associated with the Phase II Remedial Action was the Draft RD/RA-II Work Plan, with a commitment date of April 8, 2002, since the Draft RD/RA-II Work Plan was a primary document under the Federal Facility Agreement and Consent Order (FFA/CO). After the Phase II Remedial Action construction activities are complete, a pre-final inspection will be performed and a pre-final inspection report prepared. Then a final inspection will be performed after any issues raised by the pre-final inspection are addressed and resolved. Per the FFA/CO, a Draft Remedial Action (RA) Report, which is a primary document, will be submitted within 60 days after the final inspection. A schedule for the preparation and submittal of the RA Report is also included in Appendix G.

This RD/RA-II Work Plan includes a Construction Quality Assurance (CQA) Plan, Health and Safety Plan (HASP), Institutional Control Plan (ICP), and the Operation and Maintenance (O&M) Plan.

The CQA Plan provides the quality assurance requirements necessary for the Phase II Remedial Action. This includes such items as soil material testing procedures, preventive maintenance, and specific procedures used to assess data.

The HASP is submitted for information as Appendix H and provides information regarding health and safety aspects of work, including those parameters needed to meet identified ARARs as well as the specific local health and safety requirements for work at NRF. A site-specific health and safety plan will be submitted to NRF by the subcontractor performing the work prior to work commencement.

The ICP provides the guidelines for establishing institutional controls at the sites of concern and at the No Further Action sites discussed in the Phase I RD/RA Work Plan. The ICP also provides guidelines for updating institutional controls at the 8-05/6 sites, previously discussed in the 8-05/6 RD/RA Work Plan, to address the new requirements in the EPA Region 10 institutional control policy. The ICP delineates the controls necessary at each site while a work force is present at NRF in order to prevent unnecessary exposure to contaminants and to control potential disruption of the site (i.e., proper notification and approvals before removing fence, excavating in areas for future construction, etc.). In the event that there is no longer a government presence at NRF in the future, mechanisms are in place to assure that all ICs necessary to ensure protection of human health and the environment are in force.

The O&M Plan provides details for soil and groundwater monitoring, as well as specifics on site inspections and site maintenance.

The technical specifications that will be provided to the construction contractor will provide the detailed description and instructions for execution of required cover construction work activities per the design parameters contained in this RD/RA-II Work Plan. The construction specifications will provide details concerning site preparation, placement of each cover layer (i.e., compaction and slope requirements), grading, soil material requirements, and seeding requirements for the vegetative cover. These specifications will be drafted closer to the start of the construction process but prior to the bid process for the selection of a contractor, and will be submitted for regulator concurrence per the schedule in Appendix G. The technical specifications will be submitted as a modification to the Phase II RD/RA Work Plan primary document in accordance with the FFA/CO. Additional secondary plans may be established by the subcontractor.

Periodic reviews of remedies proposed in the Record of Decision for the OU 8-08 sites are required to determine whether these remedies remain protective of human health and the environment. These reviews are required within five years of the mobilization of work to implement the remedies. The next Five-Year Review for the OU 8-08 sites will be in 2004. In 2001 a Five-Year Review was conducted for the OU 8-05/8-06 sites (inactive landfill areas). The next Five-Year Review for these sites is currently scheduled for February 2006; however, to reduce redundancy, the next Inactive Landfill Areas Five-Year Review may be consolidated with the OU 8-08 Five-Year Review. If so, both the Landfill Areas and OU 8-08 Five-Year Reviews would be completed as a single document on a recurring five-year schedule thereafter.

8.0 Correlation Between Plans and Specifications

General correlation between the plans (drawings) and technical specifications will be ensured through internal NRF procedures and subcontractor project procedures. The subcontractor will perform the work in accordance with the plans and technical specifications (based on the RD/RA-II Work Plan). The initial correlation between the plans and technical specifications will be through review and approval by NRF of all required subcontractor submittals, including drawings and construction specifications. Subsequent revisions that incorporate major modifications will also be reviewed and approved by NRF, with concurrence of major conceptual changes by the Agencies, prior to issue. The review process is a verification of the completeness and correctness of a drawing and/or specification.

9.0 Design Approval Procedures and Requirements

The procedures and requirements for obtaining approval of the design documents will follow those outlined in the FFA/CO. This RD/RA-II Work Plan contains the final design of the remedial actions. This document has been reviewed for each work element from both an environmental compliance and technical standpoint. The following issues were addressed during the review process and will be factored into the detailed technical specifications, which will be submitted to the regulators for concurrence per the schedule in Appendix G:

- Compliance with ARARs
- Utilization of currently accepted technology and environmental control measures
- Adequacy of the design element plans
- Consistency with the Record of Decision
- Environmental impacts
- Implementability
- Accuracy of the cost estimate
- Utilization of currently accepted practices and techniques.

The DOE-Naval Reactors Idaho Branch Office shall have the authority to approve and accept the final design with concurrence from the EPA and the State of Idaho.

The subcontractor associated with the work involved in the Phase II Remedial Action will provide the required submittals outlined in the detailed technical specifications, including work document procedures to implement the work. These procedures will guide the work in the field and will incorporate the necessary elements identified in the RD/RA-II Work Plan, including the CQA Plan, HASP, etc. These procedures will be approved by NRF after verifying compliance with the Work Plan requirements.

10.0 Cost Estimate

The cost estimate for the Phase II remedial action activities for the identified sites is presented in Table 10-1 below. The difference in the cost estimate presented in the ROD and in the RD-II Work Plan versus the cost estimate presented here is the additional cost for the construction of an engineered cover over NRF-21A. NRF-21A was not originally selected for containment as discussed in the ROD and the RD-II Work Plan. However, based on the discussion presented in Section 2.0, containment was recommended and agreed with for NRF-21A.

Table10-1. Phase II Remedial Action Cost Estimate

Cost Elements		Estimated Costs
RD/RA-II Management and Documentation Costs		
Overall Bechtel Project Management(1)		$ 363,702
RA Construction Project Management (contractor)		$ 335,469
	Subtotal	$ 699,171
Construction Costs		
Cover Construction		$ 951,921
Soil Material Testing		$ 93,550
Contractor General Conditions(2)		$ 175,614
Contractor Overhead and Profit		$ 492,400
	Subtotal	$ 1,713,485
Total for RD/RA Phase II		**$ 2,412,656**
Operation and Maintenance Costs		
Oversight Management		$ 436,709
Operation & Maintenance		$ 2,127,480
Total for Operation and Maintenance		**$ 2,564,189**
Total for RD/RA Phase II and Operation and Maintenance		**$ 4,976,845**

1 - RA Project Management and Oversight, Remedial Design/Remedial Action Document Preparation.

2 – Costs include mobilization and demobilization, various office equipment and personnel, safety equipment and clothing, sales tax, per diem, insurance, temporary office structures, construction signs, photography, and equipment rental.

3 - O&M cost is for a 30 year period, in accordance with the ROD.

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